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FISHERY MANAGEMENT ANNUAL REPORT**

**Ed Schriever, Director**



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## LAKES AND RESERVOIR INVESTIGATIONS

### FILER PONDS CREEL SURVEY

#### ABSTRACT

A roving-roving creel survey was conducted at Filer Ponds from May 18 through October 31, 2013. Angler effort, catch, and harvest were estimated to evaluate this fishery especially with respect to the hatchery Rainbow Trout *Onchorhynchus mykiss* stocking program. We estimated anglers expended 6,798 h of effort ( $\pm 4,575$ ; 95% CI) to catch 7,925 Rainbow Trout ( $\pm 2,805$ ). Harvest was estimated at 6,538 Rainbow Trout ( $\pm 4,228$ ). Angler catch rate was 1.16 fish/h, which indicates catch rates near and slightly above management goals. Additional monitoring using tagged hatchery Rainbow Trout will lead to a better understanding of how anglers utilize hatchery Rainbow Trout released into these ponds.

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## **INTRODUCTION**

The Idaho Department of Fish and Game partnered with the Twin Falls Canal Company to produce new trout fishing ponds in the Twin Falls and Filer area. The ponds were built and are owned by the Twin Falls Canal Company and are being stocked by Idaho Department of Fish and Game.

## **STUDY SITE**

The new ponds are 7.2 km north of Filer at the intersection of 4350 North and 2300 East in Twin Falls County (Figure 1). The Kids' Pond is approximately 0.10 ha in size, with a maximum depth of 3 m. The large pond is approximately 1.2 ha of surface area, with a maximum depth of 3 m. The daily bag limit is six trout, any size. While the pond setting is rural, the location is within 16.1 km of Twin Falls and within 8 km (five miles) of Filer, making it an easy destination for many Magic Valley Region anglers. Idaho Fish and Game stocked approximately 2,900 trout (8-15 inches long) in the Filer Kids' Pond in 2013, and approximately 15,000 Rainbow Trout *Oncorhynchus mykiss* in the large pond in 2013. Stocking occurred biweekly from January through June and then stocking was re-initiated in September after water temps decreased and continued biweekly until the end of December.

## **OBJECTIVE**

A creel survey of the Filer Ponds was completed in 2013 to estimate angler effort, catch, and harvest rates. Understanding angler effort and success will be important to managing the fishery and understanding whether current bag limits are appropriate.

## **METHODS**

An access creel survey was conducted from May 18 to October 31, 2013. We surveyed anglers on three, randomly-selected weekdays and two weekend days in each 14-day period. Day periods were stratified early, middle, and late. An angler count was conducted during each survey event and angler interviews were completed in-between the count. Clerks counted individual anglers. During angler interviews, anglers were asked to report their residency status, hours fished, catch, harvest, gear type, angling methods and whether their trip was completed. If the trip was not completed, anglers were given a postcard with a unique ID number to be returned either by mail, or in a drop box located at the fishery. Postcards were sampled and completed trip information data were then assigned to the corresponding angler on the data sheet. Only completed trips were used in this creel survey for catch information.

Data were analyzed using techniques described in Pollock et al. 1994. Harvest data were compiled only for hatchery Rainbow Trout since other fish species were rarely observed. Confidence intervals of 95% were generated for the estimates.

## **RESULTS**

We interviewed 531 anglers during the survey period. The majority (79%) of the surveyed anglers had completed their fishing trip (complete = 418, incomplete = 113). Anglers who reported a complete trip angled for an average of 2.0 h ( $\pm$  1.1). The majority of anglers contacted were

shore anglers. We estimated anglers expended 6,798 h of angling effort ( $\pm 4,575$ ) during the creel survey period (Table 1). This equates to over 5,229 h/ha of fishing effort. Monthly estimates of fishing effort ranged from a low of 648 h (September) to a high of 2,508 h (May; Table 1).

Anglers caught an estimated ( $\pm 95\%$  CI) 7,925 Rainbow Trout ( $\pm 2,805$ ) throughout the creel period (Table 2). We estimated that anglers harvested 6,538 hatchery Rainbow Trout ( $\pm 4,228$ ) during the survey period. Catch rates averaged 1.16 fish/h for Rainbow Trout. Of the 418 completed trip interviews, only ten anglers (2% of completed trips) achieved full bag limits of six fish/day.

## **DISCUSSION**

The Filer Ponds are heavily utilized and in the last five years have become a very popular put and take fishery. Stocking occurs in the early spring and late fall providing unique close-to-town fishing opportunity for anglers from all over the Magic Valley. Filer Ponds have a single access road, so acquiring completed angler trip data was relatively easy. We interviewed 531 anglers during the creel survey period. The majority of surveyed anglers (79%) had completed their fishing trip. Completed trip information indicates that most anglers spent about 2.0 hours of effort at Filer pond, but rarely achieved a full bag limit of six fish. Of all the anglers interviewed at Filer Ponds that had completed their fishing trip, only 2% of those anglers achieved full bag limits of 6 fish.

Angler effort was highest at Filer Ponds in May. This estimate was likely influenced by conducting creel the day before Memorial Day. The estimate was higher than expected due to the high angler count for that day. Overall effort in May was 36% of the total overall effort in Filer Ponds between May and October. Fishing effort mainly surrounded the late spring/early summer stocking in Filer Ponds. Filer Pond stocking does cease in the warm summer months, and is again stocked in late fall to early winter. Effort and catch rates are highest in the spring months.

Comparable creel estimates for Filer Ponds are not available at this time as the fishery is relatively new. It is uncertain what effect reducing the daily bag limit from six fish per day would have on angler use or catch rates at the ponds. Two scenarios may predict angler use and catch in the fishery: either more or less anglers may target the fishery because less fish can legally be harvested per day, or those same anglers may fish multiple days to achieve a smaller daily bag limits. This creel survey provides catch and effort information for a seasonal fishery, but does not directly capture the immediate catch information based on an individual stocking event. Based only on the number of Rainbow Trout stocked during the survey and the estimate of Rainbow Trout harvested, exploitation was 37% during the survey period. This is approaching the goal for put and take hatchery trout fisheries. Additional tagging and monitoring of hatchery Rainbow Trout is necessary to better understand how anglers utilize the releases into these ponds. Also, calculating metrics such as frequency of bag and days at large for released fish can help address whether any benefits could be found by changing bag limits.



### **RECOMMENDATIONS**

1. Continue stocking Rainbow Trout during all but the summer months when water temperatures are too high.
2. Tag hatchery Rainbow Trout to evaluate days at large, angler total use and exploitation.
3. Secure a long term agreement with the Twin Falls Canal Company for public fishing access in Filer Ponds.

## OSTER POND 1 CREEL SURVEY

### ABSTRACT

A roving-roving creel survey was conducted at Oster Pond #1 from May 18 through October 31, 2013. Angler effort, catch, and harvest were estimated to evaluate the performance of stocked catchable hatchery Rainbow Trout *Onchorhynchus mykiss*. We estimated anglers expended 17,909 h of effort ( $\pm 8,749$ ; 95% CI) to catch 38,274 Rainbow Trout ( $\pm 24,400$ ). Harvest was estimated at 32,116 Rainbow Trout ( $\pm 6,705$ ). Angler catch rate was 2.13 fish/h, well above management goals. Additional monitoring using tagged hatchery Rainbow Trout will lead to a better understanding of how anglers utilize these releases within the pond.

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## **INTRODUCTION**

The Hagerman Wildlife Management Area (HWMA) includes the Hagerman State Fish Hatchery and many nearby small ponds which are stocked annually with hatchery Rainbow Trout *Oncorhynchus mykiss*. The Oster Lakes are located on the HWMA and are popular fisheries for trout, Largemouth Bass *Micropterus salmoides*, and Bluegill *Lepomis macrochirus*. The series of ponds on HWMA are fed primarily by Riley Creek and Tucker Springs. Most of the ponds to the north of the state fish hatchery are managed primarily for warm water fishes, while the ponds to the south are managed as put-and-take trout fisheries. The Riley Creek impoundment is the only pond north of the hatchery that is regularly stocked with Rainbow Trout. Because of the HWMA's importance as a waterfowl resting area during the winter and nesting area during the spring, the fishing season on the Anderson Ponds, Goose Pond, and West Pond is open from July 1 to October 31. All other waters on the HWMA, including Oster Ponds, are open from March 1 to October 31. Riley Creek, upstream of the state fish hatchery diversion, is open to fishing year-round.

A total of 16 ponds are located at HWMA including: Oster Lakes (six ponds), Anderson Ponds (four ponds), Bass Ponds (two ponds), Goose Pond, Riley Creek Impoundment, Hatchery Settling Pond, and the West Pond. Spring water flows through HWMA and is 14°C at the spring source. Hagerman Wildlife Management Area is located near several Magic Valley communities, and receives substantial fishing effort and provides opportunities to hundreds of anglers each year. Hagerman State Fish Hatchery stocks an average of 51,000 catchable Rainbow Trout annually in the fishing ponds found on the HWMA.

## **STUDY SITE**

The HWMA is located in Gooding County, along Highway 30, south of Hagerman, Idaho. The HWMA is 356 ha. Oster Pond 1 is approximately 1 ha surface area with a maximum depth of 5 m. The water supply for Oster Pond 1 is Bickel Ditch and spring water which is 14°C (Figure 2).

## **OBJECTIVE**

A creel survey of the Oster Pond #1 was completed in 2013 to estimate angler effort, catch, and harvest rates. Understanding angler effort and success will be important to managing the fishery and understanding whether current bag limits are appropriate.

## **METHODS**

An access creel survey was conducted from May 19 to October 31, 2013. We surveyed anglers on three, randomly-selected weekdays and two weekend days in each 14-day period. Day periods were stratified early, middle, and late. An angler count was conducted during each survey event and angler interviews were completed in-between the count. Clerks counted individual anglers. During angler interviews, anglers were asked to report their residency status, hours fished, catch, harvest, gear type, angling methods and whether their trip was completed. If the trip was not completed, anglers were given a postcard with a unique ID number to be returned either by mail, or in a drop box located at the fishery. Postcards were sampled and completed trip information data were then assigned to the corresponding angler on the data sheet. Only completed trips were used in this creel survey for catch information.

Data were analyzed using techniques described in Pollock et al. 1994. Harvest data were compiled only for hatchery Rainbow Trout since other fish species were rarely observed. Confidence intervals of 95% were generated for the estimates.

## **RESULTS**

We interviewed 796 anglers during the survey period. Approximately 58% of surveyed anglers had not completed their fishing trip. The average duration of completed trips was 1.9 h ( $\pm 1.2$ ). The majority of anglers contacted were shore anglers. We estimated anglers expended 17,909 h of angling effort ( $\pm 8,749$ ) during the creel survey period (Table 3). Monthly estimates of fishing effort ranged from a low of 1,891 h (October) to a high of 3,918 h (June; Table 3).

Anglers caught an estimated 38,274 Rainbow Trout ( $\pm 24,400$ ) throughout the creel period (Table 4). We estimated that anglers harvested 32,116 Rainbow Trout ( $\pm 6,705$ ) during the survey period. Catch rates averaged 2.1 fish/h for Rainbow Trout. Of the 331 completed trip interviews, only 57 (17%) achieved full bag limits of six fish/day.

## **DISCUSSION**

Oster Pond 1 is a heavily utilized fishery. Oster Pond 1 has become a very popular put-and-take fishery in the past few years. Stocking begins in the early spring and continues throughout the summer months and into early fall, providing anglers from all over the Magic Valley region a stable fishing opportunity. Due to easy access, Oster Pond 1 is the most popular fishery in the Oster Pond complex on the Hagerman WMA.

The majority of the surveyed anglers had not completed their fishing trip. Completed trip creel information indicates that most anglers spent about 1.9 hours of fishing time at Oster Pond 1, but rarely achieved a full bag limit. Only 57 interviewed anglers achieved full bag limits of six fish, indicating only 17% of the completed trip anglers achieved a full bag limit in Oster Pond 1.

Angler effort was highest at Oster Pond #1 in June. Fishing effort was relatively evenly distributed across the survey period and ranged from a high low of 11% in late fall (October) to a high of 22% in spring/summer (June). Similar to the Filer Ponds (preceding chapter), effort was higher in the spring but slowly tapered off during the summer months at Oster Pond #1. The spring water source (Bickel Ditch) provides suitable hatchery Rainbow Trout habitat throughout the year and angling effort continues at Oster #1 when other waterbodies within the region start to see declines in angling effort. The pond appears to provide a stable fishing opportunity within the Magic Valley Region.

Comparable creel estimates for Oster Pond #1 are not available due to past evaluations combining all of the complex ponds instead of looking at the individual fishery. This creel survey provides catch and effort information for a seasonal fishery, but does not directly capture the immediate catch information based on an individual stocking event. The current catch rate (2.1 fish/h) is much higher than our management objective of 0.5 fish/h and indicates that we may be able to reduce stocking within the pond and still maintain suitable catch rates for anglers. Additional tagging and monitoring of hatchery Rainbow Trout is necessary to better understand how anglers utilize the releases into this pond. Also, calculating metrics such as frequency of bag and days at large for released fish can provide additional information related to reducing stocking.

### **RECOMMENDATIONS**

1. Tag hatchery Rainbow Trout to evaluate days at large, angler total use and exploitation at Oster Pond #1.
2. Investigate whether reducing trout stocking decreases catch rates below the 0.5 fish/h identified in the Fisheries Management Plan.

## RILEY POND CREEL

### ABSTRACT

A roving-roving creel survey was conducted at Riley Pond from May 19 through October 31, 2013. Angler effort, catch, and harvest were estimated to evaluate the performance of stocked catchable hatchery Rainbow Trout *Onchorhynchus mykiss*. We estimated anglers expended 11,361 h of effort ( $\pm 7,487$ ; 95% CI) to catch 10,762 Rainbow Trout ( $\pm 6,705$ ). Harvest was estimated at 6,078 Rainbow Trout ( $\pm 4,336$ ). Angler catch rate was 0.95 fish/h, well above management goals. Additional monitoring using tagged hatchery Rainbow Trout will lead to a better understanding of how anglers utilize the releases within the pond.

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## **INTRODUCTION**

The Hagerman Wildlife Management Area (HWMA) includes the Hagerman State Fish Hatchery and supports many small ponds which are stocked annually with hatchery Rainbow Trout *Oncorhynchus mykiss*. The HWMA has a series of ponds which are fed primarily by Riley Creek and Tucker Springs. Most of the ponds to the north of the state fish hatchery are managed primarily for warm water fishes, while the ponds to the south are managed as put-and-take trout fisheries. The Riley Creek Impoundment is the only pond north of the hatchery that is regularly stocked with Rainbow Trout. Because of the HWMA's importance as a waterfowl resting area during the winter and nesting area during the spring, the fishing season on the Anderson Ponds, Goose Pond, and West Pond is open from July 1 to October 31. All other waters on the HWMA are open from March 1 to October 31, except Riley Creek upstream of the state fish hatchery diversion is open to fishing year-round.

Sixteen ponds are located at HWMA and include: 6-Oster Lakes, 4-Anderson Ponds, 2-Bass Ponds, 1-Goose Pond, 1-Riley Creek Impoundment, 1-Hatchery Settling Pond, and 1-West Pond. Spring water flows through HWMA and is 14°C. Hagerman Wildlife Management Area is located near several Magic Valley communities. As a result, the area receives heavy angling use and provides opportunities to hundreds of fishermen each year. Hagerman State Fish Hatchery stocks an average of 51,000 catchable Rainbow Trout annually in HWMA ponds.

## **STUDY SITE**

The Hagerman WMA is located in Gooding County, along Highway 30, south of the town of Hagerman, Idaho. The Hagerman WMA is 356 ha. Riley Pond is approximately 5 ha in size with a maximum depth of 2 m. The water supply for the Riley Pond is Riley Creek and spring water which is 14°C (Figure 3).

## **OBJECTIVE**

A creel survey of the Riley Pond was completed in 2013 to estimate angler effort, catch, and harvest rates. Understanding angler effort and success will be important to managing the fishery and understanding whether current bag limits are appropriate.

## **METHODS**

An access creel survey of Riley Pond was conducted from May 19 to October 31, 2013. We surveyed anglers on three, randomly-selected weekdays and two weekend days in each 14-day period. Day periods were stratified early, middle, and late. An angler count was conducted during each survey event and angler interviews were completed in-between the count. Clerks counted individual anglers. During angler interviews, anglers were asked to report their residency status, hours fished, catch, harvest, gear type, angling methods and whether their trip was completed. If the trip was not completed, anglers were given a postcard with a unique ID number to be returned either by mail, or in a drop box located at the fishery. Postcards were sampled and completed trip information data were then assigned to the corresponding angler on the data sheet. Only completed trips were used in this creel survey for catch information.

Data were analyzed using techniques described in Pollock et al. 1994. Harvest data were compiled only for hatchery Rainbow Trout since other fish species were rarely observed. Confidence intervals of 95% were generated for the estimates.

## **RESULTS**

We interviewed 486 anglers during the survey period. Approximately 58% of surveyed anglers had not completed their fishing trip. The average duration ( $\pm$  95% CI) of completed trips was 2.7 h ( $\pm$  1.8). The majority of anglers contacted were shore anglers. We estimated anglers expended 11,361 h of angling effort ( $\pm$  7,487) during the creel survey period (Table 5). Monthly estimates of fishing effort ranged from a low of 426 h (October) to a high of 3,396 h (May; Table 5).

Anglers caught an estimated 10,762 Rainbow Trout ( $\pm$  6,705) throughout the creel period (Table 6). We estimated that anglers harvested 6,078 Rainbow Trout ( $\pm$  4,336) during the survey period. Catch rates averaged 0.95 fish/h for Rainbow Trout. Of the 161 completed trip interviews, only 18 (11%) achieved full bag limits of six fish/day.

## **DISCUSSION**

Riley pond has become a very popular put-and-take fishery in the past two years. This pond is stocked in the early spring, summer, and early fall and provides anglers from all over the Magic Valley Region a consistent fishing opportunity. The majority of angler we surveyed had not completed their fishing trip. However, based on completed trip creel information, most anglers spent about 2.7 hours of fishing time at Riley Pond, but rarely achieved a full bag limit of six fish. Eighteen interviewed anglers (11% of the completed trip anglers) achieved full bag limits of six fish.

Angler effort was highest at Riley Pond in May. Overall fishing effort in May was nearly 30% of the total overall effort in the pond during the surveyed period. Fishing effort was higher in the spring and slowly tapered off going into the fall with October generating the lowest estimate of fishing effort at only 4% of the survey total. This pattern appears to be consistent with the other ponds that were surveyed in 2013 (Filer Ponds and Oster Pond #1). Riley Pond also maintains suitable habitat for hatchery Rainbow Trout through the hot summer months and continues to be stocked from February through late September.

Comparable creel estimates for Riley Pond are not available due to past evaluations combining all of the complex ponds instead of looking at an individual fishery. This creel survey provides catch and effort information for a seasonal fishery, but does not directly capture the immediate catch information based on an individual stocking event. The current catch rate (0.95 fish/h) is higher than our management objective of 0.5 fish/h. Based only on the number of Rainbow Trout stocked during the survey and the estimate of Rainbow Trout harvested, exploitation was 30% during the survey period. Some of the stocked Rainbow Trout may have been caught and harvested in other areas of the WMA due to connectivity to other ponds and waterbodies. Additional tagging and monitoring of hatchery Rainbow Trout is necessary to better understand how anglers utilize the releases into this pond. Also, calculating metrics such as frequency of bag and days at large for released fish can provide additional information related to reducing stocking and moving the excess fish to another waterbody.



## **RECOMMENDATIONS**

1. Tag hatchery Rainbow Trout released into Riley Pond to evaluate days at large, angler total use and exploitation. This will provide additional insight into whether or not reducing stocking densities and frequency is warranted.

## HAGERMAN WILDLIFE MANAGEMENT AREA

### ABSTRACT

Water distribution mapping and water delivery structure inventory was conducted on the Hagerman WMA in 2013. We documented and evaluated 10 water control structures in the Oster Ponds complex. We chemically treated the Oster Lakes complex within the HWMA using rotenone in August 2013 to eliminate Common Carp *Cyprinus carpio* and to help restore bass and panfish angling opportunities. Following chemical treatment, Bluegill *Lepomis macrochirus* were reintroduced to the Oster Lakes complex in the fall of 2013.

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## INTRODUCTION

The Hagerman Wildlife Management Area (HWMA) includes the Hagerman State Fish Hatchery and supports many small ponds which are stocked annually with hatchery Rainbow Trout. The Oster Lakes are located on the HWMA and are popular fisheries for Rainbow Trout *Oncorhynchus mykiss*, Largemouth Bass *Micropterus salmoides*, and Bluegill *Lepomis macrochirus*. Hagerman Wildlife Management Area has a series of ponds which are fed primarily by Riley Creek and Tucker Springs. Most of the ponds to the north of the state fish hatchery are managed primarily for warm water fish, while the ponds to the south are managed as put-and-take trout fisheries. The Riley Creek Impoundment is the only pond north of the hatchery that is regularly stocked with trout. Because of the HWMA's importance as a waterfowl resting area during the winter and nesting area during the spring, the fishing season on the Anderson Ponds, Goose Pond, and West Pond is open from July 1 to October 31. All other waters on the HWMA including the Oster Lakes are open from March 1 to October 31. Riley Creek, upstream of the state fish hatchery diversion, is open to fishing year-round.

A total of 16 ponds are located at HWMA including: Oster Lakes (six ponds), Anderson Ponds (four ponds), Bass Ponds (two ponds), Goose Pond, Riley Creek Impoundment, Hatchery Settling Pond, and the West Pond. Spring water flows through HWMA and is 14°C at the spring source. Hagerman Wildlife Management Area is located near several Magic Valley communities, and receives heavy fishing pressure and provides opportunities to hundreds of anglers each year. Hagerman State Fish Hatchery stocks an average of 51,000 catchable Rainbow Trout annually on HWMA. Since 1940, a series of 16 ponds have been developed with dikes and dams to provide habitat for fish and wildlife and to create recreational opportunities. Water and wetland vegetation constitutes about 66 ha of the total area.

The aquatic habitat is suitable for both cold water and warm water fish species depending on spring inflow and distance from spring heads. The ponds are shallow with mean water depths of approximately 1 m and maximum depths of 2.0 – 2.5 m. All ponds are characterized by having muck (decaying organic matter) bottoms which support extensive algae growth during the summer. Overhanging vegetation is present around all ponds where trees and shrubs are abundant.

Based on a 2011 angler economic survey (IDFG unpublished data), the fishery at HWMA stimulates over \$1,000,000 in angling-related spending. Annual cost to IDFG for fish stocking is about \$40,000 based on the average annual stocking of 51,000 catchable trout/year.

Historically, the Hagerman Wildlife Management Area provided some of the best Largemouth Bass and Bluegill fishing opportunities in the Magic Valley region. The Oster Lakes provided fishing opportunity for bass and Bluegill, with anglers fishing from both the bank and from float tubes. In the mid to late 1990's the quality of the warm water fishery declined as Common Carp *Cyprinus carpio* became established throughout the HWMA pond complex. Common Carp are native to Asia and are known to alter water quality, reduce primary productivity, and severely impact warm water fisheries (American Fisheries Society 1987). They compete heavily for food as well as habitat. They are fast growing and can produce millions of offspring. Once carp become established in a fishery, they are extremely difficult to control. In 2011, IDFG started a multifaceted approach to understanding the fishery dynamics on the HWMA. This included conducting an angler creel survey for comparison to the 1980s survey and inventorying water structures and water movement, as well as estimating carp occurrence and abundance throughout the HWMA.

Creel survey results indicated the angler use of the HWMA fisheries had significantly declined, which may be a result of declining warmwater fisheries due to impacts from Common Carp (hereafter carp). The Department determined carp were present and relatively abundant in all but three ponds (Bass Ponds and the Goose Pond) on the HWMA. Carp presence was determined visually or by sampling the fisheries with electrofishing and trap nets. The Department concluded that most of the resident fisheries would benefit if carp were removed or significantly reduced.

To accomplish this goal, we considered management options ranging from no action to complete renovation, with complete renovation being the most extreme and resource heavy alternative. In 2011, IDFG also physically removed all carp from Oster Pond 1 by draining the pond.

In 2012, all water control structures on the Bass Ponds and Anderson Ponds were surveyed to document barriers against carp movement between fisheries on the HWMA. By controlling carp movement, IDFG could then survey each fishery separately. In 2012, IDFG chemically removed carp from Anderson Ponds 1 and 2 using the piscicide rotenone.

The goal of this effort is to improve the sportfish angling opportunity on the HWMA and Oster Lakes and increase angler use to levels that would match or exceed those estimated for 1984 (Grunder et al. 1986). In addition, we intend to work collaboratively with the HWMA manager to develop a long-term fishery management plan.

## **STUDY SITE**

The HWMA is located in Gooding County, along Highway 30, south of the town of Hagerman, Idaho. Hagerman WMA is 356 ha. The Oster Lakes Complex resides within the WMA and includes six interconnected ponds located on the southeast portion of the HWMA. This report encompasses phase 2 of the overall fishery restoration plan and pertains only to the Oster Lakes complex. (Figure 4) The water supply for the Oster Lakes is the Bickle Ditch (Figure 5). Spring water is 14°C.

## **OBJECTIVE**

The objectives of this study were three fold: 1) complete a water distribution schematic and water delivery structure inventory on Oster Lakes 2-6; 2) eradicate Common Carp from Oster Lakes 2-6; and 3) re-establish a warmwater fishery in Oster Lakes 2-6.

## **METHODS**

### **Water Control Structures**

Water control structures were inventoried throughout the entire Oster Lakes complex on HWMA. We visually located and evaluated the existing control structures. For each structure, we assigned a GPS location, identified the type of water control structure (whistler tube, dam boards, etc.), evaluated overall functionality, documented any needed repairs, and determined whether the control structure would serve as an upstream fish passage barrier. Water flow schematics were generated for future management planning (Figure 6).

## Rotenone Application

Prior to the application of rotenone, Largemouth Bass and Bluegill were salvaged from the Oster Lakes with electrofishing and trap nets (see Appendix B for equipment details). Fish were transported and temporarily held in the Goose Pond on the HWMA located approximately 0.5 km from the treatment area. These salvaged fish would later serve as a source for reintroduction following the rotenone application.

Several steps were taken to maximize the efficiency of the renovation. The Oster Pond complex was drawn down to isolate the ponds (no outflow), and to reduce the pond volume and amount of chemical needed. On August 1, 2013, inflow to the Oster Pond complex was reduced to bare minimum levels ( $< 1$  cfs) needed to preserve the put-and-take trout fishery in Oster Pond #1 (headwater pond), which was treated in 2011 to remove carp. All impoundment structures downstream of Oster Pond #1 were opened allowing the impoundments to deplete as far as possible. The ponds remained without inflow for 21 days prior to the application of rotenone to allow as much water as possible to sub-out or evaporate to minimize the volume of water to be treated (Figure 7). Additionally, the drawdown isolated the remaining fish from the complex shoreline cover and concentrated them in shallow pools which would simplify the actual treatment and increase the probability of a complete eradication.

During this period of drawdown, we observed one outlet structure that might allow rotenone to move from Oster Pond #5 into Riley Creek. This structure was reinforced (i.e. sealed) using visqueen. However, we also prepared a potassium permanganate, rotenone detoxification station at that location in the event the repair was not sufficient. This station was prepared to detox a discharge of  $< 1$  cfs.

We estimated the volume of each remaining pool to determine the quantity of rotenone product needed for an effective treatment. Pool volumes were estimated by determining the average width and depth of each remaining pool. We used a range finder and manually measured depths from a boat. Pre-treatment volume estimates are found in Table 7.

We followed rotenone application guidelines as outlined in the Planning and Standard Operating Procedures for the Use of Rotenone in Fish Management (Finlayson et. al 2000). Synpren © Fish Toxicant (2.5% rotenone aqueous solution) was used to renovate the pond complex. We adhered to label prescribed mixing and application requirements. The ponds were treated at a rate of 8 ppm, the prescribed rate for carp in an organic rich environment. Fish toxicant was applied with backpack pesticide application sprayers, an ATV pesticide application setup (2.5-m boom) retrofitted for a boat, and by a shoreline based water pump (output of  $0.0003 \text{ m}^3/\text{s}$ ) that drew from a shoreline-based tank of premixed rotenone solution. The shoreline based solution was delivered by boat and from the shore through approximately 100 m of garden hose.

Sentinel cages were used to determine treatment efficacy. Cages containing eight to ten Bluegill were deployed into all five treated locations. These cages were checked to confirm if the product was applied at a lethal concentration with success being confirmed if the fish within the cage expired. An additional sentinel cage was placed below the outlet of Oster Pond 5 to determine if rotenone-laced water was escaping and thus signal the need to start detoxification.

We began to reintroduce water into the Oster Pond complex after we confirmed a complete kill. The water was introduced slowly to dilute the treated water and facilitate oxidation of the rotenone product. Sentinel fish cages were used to determine when the rotenone oxidized sufficiently and concentrations were no longer lethal. Cages containing live fish were placed in

three locations approximately every 3 days and evaluated after 24 hours. This testing continued until fish were documented to survive at least 24 hours. We slowly introduced water to the system 15 days after the treatment was complete.

We re-established normal water flows once we confirmed the rotenone was no longer present at toxic concentrations. All dam boards and control structures were closed allowing all ponds to fully recharge. Bluegill transplants were implemented throughout September and early October 2013 once full recharge was achieved (28 days after treatment).

## **Warm Water Fishery Restoration**

We used methods outlined in Soderberg and Swistock (1995) to rebuild the warm water fishery in the Oster Pond complex. This method of Largemouth Bass and Bluegill pond management was developed for northern latitude farm ponds. The protocol for establishing a new Largemouth Bass/Bluegill fishery required Bluegill to be introduced first. Bluegill reintroduction into Oster Ponds 2-6 took place in September and October 2013. Fish were trap netted from the Goose Pond on the Hagerman WMA, and hauled in transport tanks by pickup truck to the Oster Ponds. Ponds were stocked only with Bluegill in 2013, with Largemouth Bass stocking scheduled for early spring 2014. We transplanted Bluegill ranging in size from 72 – 210 mm into each of the Oster ponds to achieve an initial density of 247 Bluegill/ha (100/acre, Soderberg and Swistock 1995). In order to achieve a balanced fish population, research in northern latitude Pennsylvania bass/Bluegill ponds by Soderberg and Swistock (1995), suggests a prescription of bass/Bluegill density ratio of 25/100 per surface acre.

## **RESULTS**

### **Water Control Structures**

In all, we documented and evaluated 10 structures that controlled water in the Oster Ponds complex. All diversions showed significant decay of wooden dam boards; these were all replaced. New boards were cut, and visqueen © was affixed to the face of the dam boards (Table 8).

All ten structures were upstream migration barriers once the dam boards were in place. In all cases, the migration barrier was created through vertical drop (> 1.0 m) resulting from a surface release design. A steel migration barrier was placed at the outflow of Oster Lake 1(Figure 8).

### **Rotenone Application**

In all, approximately 12 Largemouth Bass and 1,700 Bluegill were captured and transported from the Oster Lakes and released into the Goose Pond prior to the rotenone. Total trapping effort included 7 trap nets and 35 net nights on Oster Lakes 2, 3, 4, and 5. We electrofished for a combined two hours on Oster Lakes 2 and 3. No lengths or weights were taken during salvage efforts.

The pre-rotenone drawdown was a successful approach toward maximizing treatment efficiency. The resulting standing pools were completely isolated from the connecting streams and no detoxification stations were activated during the treatment. The volume of water to be treated was substantially reduced and fish access to complex habitat was essentially eliminated.

Renovation of Oster Lakes 2, 3, 4, 5, and 6 was conducted on August 22, 2013. Treatment was initiated at approximately 0900 h and completed by 1430 h. We cumulatively applied 245 liters of product into the five impoundments. Lethal concentrations were confirmed within 12 hours of initial application.

Detoxification was established approximately 21 days after treatment. Fresh water was introduced into the pond complex approximately 19 days after treatment to accelerate the dilution of the rotenone solution. Twenty-four hour fish survival was confirmed 22 days after treatment.

### **Warm Water Fishery Restoration**

Bluegill reintroduction was completed in Oster Ponds throughout September and October 2013. Bluegill were restocked at a rate of 100 Bluegill/acre (247/ha). Full pool surface ha and prescribed stocking is described in Table 10. No mortality occurred during the transplant process. A subsample of 100 Bluegill were measured prior to release (Figure 9).

## **DISCUSSION**

### **Water Distribution**

Water control structures on the HWMA Oster Ponds were inventoried and located in the spring of 2013. Ten control structures were located and documented. Understanding the water flow through the HWMA allows both the fishery and the habitat personnel to better understand water use and distribution. It also allowed for the structures that were no longer needed to be abandoned and better water usage and delivery was achieved. This allows for better flow through the entire WMA system to provide enhanced water for both fisheries and wildlife (Table 9).

### **Rotenone Application**

Treatment time to dispense all chemical lasted longer than planned because the johnboat spray unit dispensed the product more slowly than anticipated. No removal of dead fish took place after the treatment. Most fish were quickly scavenged within a couple days by both birds and mammals. Pond recharge began one week after treatment, when lethal concentrations were no longer present in the treatment area. Ponds were fully recharged within six days. Visual observations were conducted by johnboat and driving the shore line soon after the ponds were recharged, and no carp were observed. Follow-up monitoring via boat on Oster Lakes 2, 3, 4, 5, and 6 will be completed to deem the project successful. Upstream barriers are in place on Oster Lake 1.

Continued water distribution investigations are ongoing in Riley Pond, Anderson Pond 3 and 4, as well as the West Highway Pond. Carp are present in four ponds and will be chemically eradicated in the future once water distribution and drawdown options become better understood.

### **Bluegill Reintroduction**

Full stocking density goals for Bluegills were achieved in Oster Ponds 2, 3, 4, 5, and 6. Densities of 100 adult (>2 yr old) Bluegill per surface acre were achieved (Table 10). Stocking densities were obtained from research performed in Northern latitude bass ponds in

Pennsylvania. Bass and Bluegill combinations are generally successful over time with each species influencing the population density of the other (Boyd 1990). These densities over time will result in either a bass-crowded or Bluegill-crowded pond. Desired pond management is ultimately achieved through harvest. Monitoring each pond is essential to overall bass and Bluegill pond management. A simple method of assessing the current status of a pond fishery is the use of proportional stock density (PSD). The PSD method is applicable to ponds dominated by a Largemouth Bass and Bluegill in combination. Understanding the bass crowded and the Bluegill crowded pond biology (Wolf et. al. 2009) gives a better understanding of what monitoring should be done for future management implications (Figure 10).

Oster Ponds 2, 3, 4, 5, and 6 are stocked with Bluegill, and will be stocked with Largemouth Bass in the spring of 2014. This will provide each pond an initial out plant of 25 Largemouth Bass per acre, and 100 Bluegill per acre. All the Oster Lakes provide good spawning habitat for both Largemouth Bass and Bluegill. All the ponds appear to also provide good food for juvenile fish with good primary productivity and plant growth in the ponds.

Once bass and Bluegill fisheries become established in Oster Lakes 2, 3, 4, 5, and 6, a number of management options exist. We have the ability to manage harvest for a different fishing experience, should the angler want the option of large Bluegill fishing, or large bass fishing. Management options to provide quality fishing in the Oster Pond Complex for bass and Bluegill are ultimately dependent on what the public (anglers) wants for a quality fishing experience.



## **RECOMMENDATIONS**

1. Reintroduce the prescribed density of Largemouth Bass in the spring of 2014 prior to the Bluegill spawn.
2. Monitor newly established Bluegill and Largemouth Bass populations. In three years, evaluate the predator/prey balance in Oster Ponds 2-6. Compare both fish species PSD and implement appropriate management if warranted.
3. Implement Phase 3 of the Hagerman WMA fishery restoration effort. Eradicate Common Carp from Riley Creek (from hatchery diversion to Riley Creek Falls), Riley Pond, Anderson Pond #3 and #4, and the West Highway Pond.
4. Evaluate habitat conditions for Bluegill and Largemouth Bass in all newly renovated warm-water fisheries on the Hagerman WMA. Implement enhancements that would improve production and achieve a more ideal open water/cover ratio.

## LOWER SALMON FALLS RESERVOIR

### ABSTRACT

Largemouth Bass *Micropterus salmoides* (LMB) monitoring was initiated at Lower Salmon Falls Reservoir in 2013. A total of 64 LMB were sampled using 12 units of standard bass monitoring effort at randomly selected sites around the reservoir. Catch rate (CPUE) were estimated at  $25 \pm 8$  bass/h. PSD was 55 with a RSD-Q of 45. Mean relative weights were 105 and 110 for stock and quality bass, respectively. The LMB size structure showed only slight differences in the 2013 survey as compared to the previous survey in 2009. Bass PSD was nearly identical between surveys where PSD was 56 and 55 in 2009 and 2013, respectively.

The Largemouth Bass population in Lower Salmon Falls Reservoir is made up of less than desirable sized bass, with about 69% below the slot, 30% in the slot, and about 1% above the slot. Our sampling may be biased against larger fish, but the overall catch was consistent through the 2008, 2009, and 2013 sampling events.

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## **INTRODUCTION**

Lower Salmon Falls Reservoir (Bell Rapids) was created by the construction of Lower Salmon Falls Dam on the Snake River upstream from Bliss in 1907, at the site of a natural falls. A new dam, constructed at the site in 1949, increased the reservoir volume impounding water upstream for a distance of 11 km. The reservoir has a surface area of approximately 340 ha and a maximum depth of about 12 m. While dominated by non-game species such as Common Carp *Cyprinus carpio* and sucker spp, the reservoir supports a fishery for Largemouth Bass *Micropterus salmoides*, Smallmouth Bass *Micropterus dolomieu*, and stocked Rainbow Trout *Oncorhynchus mykiss*. Since 1996, Lower Salmon Falls Reservoir has been managed for quality bass fishing with mandatory catch-and-release from January 1 to June 30, and a 2-fish protected slot limit (none between 305-406 mm) from July 1 to December 31.

In 2013, a bass population monitoring program was initiated on Lower Salmon Falls Reservoir. Information gathered from this survey and future surveys will be used to provide insight on bass population dynamics in addition to evaluating the utility of existing restrictive angling regulations. Sampling in 2013 will be used as trend monitoring for bass in Lower Salmon Falls Reservoir.

## **STUDY SITE**

Lower Salmon Falls Reservoir is located in Gooding County, Idaho and has a surface area of approximately 340 ha and a maximum depth of about 12 m. Lower Salmon Falls Dam was built in 1910 by the Greater Shoshone and Twin Falls Water Power Company. Idaho Power Company acquired the plant in 1916 and rebuilt it in 1949. The plant has a total nameplate generating capacity of 54,300 kilowatts and includes a dam and powerhouse with four generators. It's located at river mile 573, near the town of Hagerman, Idaho (Figure 11).

## **OBJECTIVE**

The overall objective of this 2013 sampling effort was to establish long-term monitoring baseline information, and to describe the overall population health of the Largemouth Bass fishery and address fishing rule proposals in the Lower Salmon Falls Reservoir bass fishery. Bass monitoring is conducted to identify Largemouth Bass population trends and better understand population dynamics. Monitoring population trends will help evaluate fishing regulation scenarios and changes in angler exploitation, population dynamics, or effort.

## **METHODS**

The bass monitoring protocol is used to monitor Largemouth Bass populations within the Magic Valley Region. This survey technique provides data for the evaluation of relative abundance (expressed as catch/unit effort), stock structure, fish condition ( $W_r$ ), fish growth (length at age), and fish survival (catch curve analyses).

Largemouth Bass monitoring is conducted in the spring with water temperatures between 15°C and 24°C when Largemouth Bass are known to spawn (Heidinger 1975). Surveys occur at night using a boat electrofisher manned with two netters targeting only bass (See Appendix B for

gear description). Each electrofishing sample (unit effort) consists of 15 minutes of shocking effort (power on) at randomly chosen sample sites throughout the reservoir.

Relative abundance was expressed as mean catch per unit effort (CPUE). Sample size goals for electrofishing units are based on the variance around the mean CPUE and power analysis, with minimum sampling effort being determined in situ during sampling. While in the field, a sample size estimator incorporated into a PDA (Personal Digital Assistant – i.e. electronic data device) provides real-time estimates of the mean CPUE, the associated precision of that estimate, and estimated sampling units needed to achieve a desired precision (PDA software: Data Plus Solutions Software©, Cohen 1988). Ideally, sampling continues until the variation around the mean CPUE achieves an 80% confidence (t-value = 1.26). However, high variation among sampling units sometimes may preclude achieving the desired precision and sampling concludes when time becomes limited. Electrofishing samples followed standard bass population monitoring methods at randomly chosen sample sites throughout the reservoir (Appendix A). Twelve units of sampling were conducted.

All Largemouth Bass sampled were measured for total length (TL, mm) and weighed (g). Efforts were made to collect at least 5 fish from each cm length group between the smallest and largest bass sampled during the effort. Otoliths were prepared for age estimation by breaking the otolith centrally, burning or browning the broken edge with an alcohol burner, and viewing the otolith with a dissecting microscope at 30X – 40X magnification. Otoliths were coated with mineral oil to improve viewing clarity (Devries 1996). Mean length-at-age was calculated from the subsample of fish. Fish growth was evaluated from the mean-length-at-age summary using FAST software (Fisheries Analysis and Simulation Tools, Version 2.1©).

Stock structure and condition indices were generated in FAST software. Proportional stock density (PSD) was calculated to index the Smallmouth Bass population stock structure (Anderson and Neuman 1996). Relative weights ( $W_r$ ) were calculated in EXCEL® software and were reported as the mean  $W_r$  of individual fish from the catch.

Mortality and survival were estimated to evaluate the effects of exploitation and other limiting factors. Annual mortality and survival were estimated using a catch curve (Van Den Avyle 1993) generated using FAST® software.

## **RESULTS**

The Largemouth Bass monitoring of Lower Salmon Falls Reservoir (Bell Rapids) was completed on May 28, 2013. A total of 64 Largemouth Bass were sampled with 12 units of effort, resulting in a mean CPUE of 25 bass/h ( $\pm 8$ ; 80% CI).

Bass length ranged from 90 - 460 mm in 2013 and was similar to 2008 and 2009 (Figure 12). Weight ranged from 20 - 2,000 (g). Bass PSD was 55 and RSD-Q was 45. Relative weights were 105 for stock and 110 for quality bass, respectively (Figure 13).

A subsample of 54 Largemouth Bass were aged, revealing six age classes (Figure 14). Length at age-5 was 375 mm (Table 11). Theoretical maximum age, as determined by catch curve regression, was estimated at 14 years and total annual mortality for Largemouth Bass from age-3 to age-6 was estimated at 17% (Figure 15).

## **DISCUSSION**

The mean CPUE in 2013 (25 bass/h) represents an approximate 34% decrease compared to the previous estimate in 2009 (CPUE = 38 bass/h; Stanton et al. 2014). Despite the lack of statistical significance (based on overlapping confidence intervals), this downward trend continues from the higher catch rates reported in Stanton et al 2013. Our 2013 mean CPUE decreased compared to the 2009 survey, but fell within the confidence limits of the long-term average.

Largemouth Bass growth appears to have slightly increased. For this effort, we used length at age-5 to index growth. Observed length at age-5 in 2013 was 375 mm compared to 325 in 2009 (Stanton et. al 2014). It's possible that environmental conditions within the reservoir have shifted to benefit bass growth since the last survey (e.g. warmer water temperatures or change in flow management). Additional aging structures should be collected during the next survey to better understand growth within this population of Largemouth Bass.

The Largemouth Bass size structure showed only slight differences in the 2013 survey as compared to the previous survey in 2009 (Figure 12). Bass PSD was nearly identical between surveys. PSD was 56 and 55 in 2009 and 2013, respectively. Size structure analyses indicated that 69% of the sample population was less than 305 mm, and only five fish in the sample population were more than 406 mm.

Mean relative weights increased in 2013 as compared to mean relative weights sampled in the 2009 sample (Stanton et al. 2014). Relative weights in the larger bass of the 2013 sample increased. More, larger bass were also sampled in the 2013 sample. Relative weights sampled in both 2009 and 2013 samples suggest bass condition is good for all size classes. The relative weights of bass sampled in the 2009 sampling event showed most fish at or slightly above 100%, with the relative weight of 105 for stock and 110 for quality bass. The relative weights of bass sampled in the 2013 sampling event showed most fish above 150%, suggesting very good condition for both stock and quality sized bass, as well as bass longer than 350 mm. This supports that growth has likely improved within the population since 2009.

Evaluation of the current size structure of Largemouth Bass, under slot-limit restrictions in Lower Salmon Falls Reservoir, suggested current regulations may not be biologically appropriate in this reservoir. It may be more appropriate to evaluate a 406 mm (16 inch) minimum length restriction to protect smaller sized bass. Slot-limit length restrictions are typically recommended in populations with high recruitment and slow growth (Anderson 1996). Anderson (1996) also stated that the proper function of length slot-limits was to increase numbers of size-protected fish, promote growth of smaller fish by reducing interspecific competition through angler harvest, and increase production of trophy fish. Dillon (1992) suggested Idaho bass populations are limited by inconsistent recruitment related to regional weather patterns and water level management. Therefore, slot-limit length restrictions would not be suitable for most Idaho Largemouth Bass populations. Relative abundance of Largemouth Bass, by designated size groups in the catch, indicated age-2 and 3 fish made up 48% of the sample. Largemouth Bass in Lower Salmon Falls Reservoir have slightly higher than average growth rates, reaching up to 375 mm by age-5. This suggests bass could easily surpass the 406 mm slot limit and be available for harvest by age-6 (Figure 14).

Exploitation of Largemouth Bass in this system is currently unknown. However, the size structure of the bass population shows very few bass over 406 mm, which may be a function of angler harvest (Figure 12). Developing exploitation estimates will help answer whether the

appropriate regulation for the waterbody should be a slot-limit or a minimum size restriction. Understanding how angler utilize bass both below and above the current slot-limit will provide better management guidance. Low exploitation levels may generally limit the need and/or utility of length restrictions in this system. To date, no angler comments have been received that express discontent regarding current Lower Salmon Falls Reservoir Largemouth Bass regulations and/or size structure. It is recommended that population trends and angler satisfaction be monitored periodically to identify any changes over time.

### **RECOMMENDATIONS**

1. Evaluate angler use and exploitation on the bass fishery at Lower Salmon Falls Creek Reservoir.
2. Continue 3-year bass monitoring following standard protocol at the reservoir.

## **SALMON FALLS CREEK RESERVOIR**

### **ABSTRACT**

Fall Walleye Index Monitoring (FWIN) was conducted to evaluate the Walleye *Sander vitreus* populations in Salmon Falls Creek Reservoir in 2013. A total of 260 Walleye were sampled. Mean catch-per-unit-effort was 33 Walleye/net-night ( $\pm 5$ ; 95% CI) and ranged from 12 to 60 Walleye/ net-night. Proportional stock density (PSD) was 14.5 with a relative stock density-quality (RSD-Q) of 85. Mean relative weights were 84% for stock and 89% for quality Walleye. Stock density of the catch was 14, 5, 3, and 0.4 % for PSD, RSD-P, RSD-M, and RSD-T, respectively. Total length of sampled Walleye ranged from 135 to 770 mm. The mean age of Walleye sampled was three.

Walleye had a mean gonadal somatic index of 5 for males and 26 for females. Mean relative weights for each size class of Walleye were 84, 89, 98, 103, and 105 % for stock, quality, preferred-, memorable-, and trophy-sized Walleye, respectively. Mean visceral fat indices were 4 for males and 56 for female Walleye. Weight ranged from 18 g to 5,600 g.

The overall FWIN ranking was 2.5, on a scale from 1-3, indicating the fishery is classified as being between “healthy and stable” and “stressed and unstable”. This index was derived from four ranked indices combined including: 1) Mean CPUE  $\geq 450$  mm = 1.13 (SD = 1.2), 2) age classes present (with  $n > 1$ ) = 13, 3) max age = 16 years, and 4) a female diversity index value = 1.1.

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## **INTRODUCTION**

Salmon Falls Creek Reservoir (SFCR) is a 1,400-ha irrigation impoundment located on Salmon Falls Creek in Twin Falls County, ID (Figure 16). SFCR is unique to the Magic Valley Region in that during construction a large, inactive storage capacity was created, inadvertently creating productive fish habitat even in low water years. SFCR is managed as a mixed-species fishery for Rainbow Trout *Oncorhynchus mykiss*, Walleye *Sander vitreus*, Kokanee *Oncorhynchus nerka*, Yellow Perch *Perca flavescens*, Smallmouth Bass *Micropterus dolomieu*, and Black Crappie *Pomoxis nigromaculatus*. SFCR is one of only three waters in Idaho managed specifically to provide a Walleye fishery. SFCR is also a popular recreational lake, and is considered one of the best fisheries in southern Idaho.

Salmon Falls Dam is constructed across Salmon Falls Creek in Twin Falls County, Idaho in the United States. Located about 40 km south of Buhl, the dam is 66-m high and 140-m long, impounding up to 230,648 acre-ft of water in Salmon Falls Creek Reservoir. When full, the reservoir extends for 27 km upstream. The dam and reservoir control runoff from a drainage basin of 4,200 km<sup>2</sup> capturing water from basins found in both Nevada and Idaho. Much of the basin receives less than 25 cm of precipitation annually, while the mountainous areas may get up to 76 cm. The dam was built in 1910 to provide irrigation water storage, and is owned and operated by the Salmon River Canal Company. A secondary purpose is flood control; though, the dam has never spilled floodwaters with the exception of the heavy snowmelt of 1984.

## **OBJECTIVE**

Fall Walleye Index Netting (FWIN; Curruthers et al. 2008) was completed in 2013. This sampling regime has been utilized at five-year intervals to gather information on abundance, growth, mortality, reproduction, and diet. Data from this analysis will be compared to three consecutive annual samples completed between 2006 and 2008 on SFCR.

## **METHODS**

The FWIN survey took in October 2013. FWIN was initiated to monitor Walleye population trends and better understand population dynamics. FWIN data will also be used in future regulation evaluations. Standard FWIN protocols described in the Manual of Instructions – Fall Walleye Index Netting (Morgan 2002) were used in sampling efforts (Appendix B). A sample size target of 300 Walleye was set prior to sampling, and sampling was discontinued when sample size was achieved. Gillnets were eight panel monofilament nets 1.8 m deep, 61.0 m long, with 7.6-m panels measuring 25, 38, 51, 64, 76, 102, 127, and 152 mm stretched mesh. Net locations were randomly selected and are listed in Appendix A. Net sets were equally split between two depth strata including 2-5 m and 5-15 m depths. All nets were placed perpendicular to the shoreline. Netting was conducted when water temperatures were between 10°C and 15°C.

All Walleye sampled were measured (TL, mm) and weighed (g). All by-catch species were measured, with a sub-sample weighed. Otoliths were sampled from all Walleye and prepared for age estimation by breaking centrally. Otolith evaluation was contracted to Ron Brooks, University of Illinois. Growth rates were evaluated by estimating mean length at age by sex.

Mortality and survival were estimated to evaluate the effects and interaction of exploitation and natural limiting factors on the fishery. Walleye annual mortality and survival were estimated



using a catch curve (Van Den Avyle 1993). Catch curves were generated in FAST (Fisheries Analysis and Simulation Tools, Version 2.1).

Condition indices were generated from sampled Walleye to describe the general health of the population. Visceral fat was removed and weighed to measure condition as a visceral fat index. The visceral fat index was calculated as the ratio of visceral fat weight to total body weight and described as a percentage. Gonads were removed and weighed to estimate a gonadal somatic index value for each fish. The gonadal somatic index value was calculated as ratio of gonad weight to body weight and described as a percentage. Relative weights were calculated and summarized by angler perspective stock size groups in FAST (Anderson and Neumann 1996).

All Walleye were evaluated for sexual maturity (Duffy et al. 2000). Total length and age at 50% maturity was determined using logistic regression (Quinn and Deriso 1999). A female diversity index value was estimated, based on the Shannon diversity index, to describe the diversity of the age structure of mature females (Gangle and Pereira 2003). The female diversity index has been shown to be sensitive to exploitation and may provide indications of overexploitation (Gangle and Pereira 2003). Ovaries were sampled from mature females for an estimation of fecundity. Fecundity estimates were generated for a sub-sample of eggs that were weighed and counted from each fish. Fecundity estimates will be used in future population modeling.

Benchmark classifications developed for Ontario Walleye management (George Morgan, Laurentian University Sudbury, Ontario, personnel communication) were applied to SFCR data. Benchmarks were used to classify the relative condition of the Walleye population. Classification parameters included: CPUE for Walleye  $\geq 450$  mm, number of age classes present, maximum age, and female diversity index. Parameters represented measures of abundance, growth, age structure, and recruitment potential. Parameters were scored from one to three, three reflecting a healthy stable population. The average score among all parameters reflected the overall health of the population.

## **RESULTS**

Fall Walleye Index Netting was completed on October 8 and 9, 2013. A total of 8 net nights were completed resulting in a total catch of 260 Walleye. Catch per unit effort averaged 33 Walleye/net-night ( $\pm 5$ , 95% CI) and ranged from 12 to 60 Walleye/net-night.

Total length of sampled Walleye ranged from 135 to 770 mm in 2013, and was comparable to 2006, 2007, and 2008 (Figure 17). Weight ranged from 18 to 5,600 g. Average age of Walleye sampled was three years. Stock density of the catch was 14, 5, 3, and 0.4 % for PSD, RSD-P, RSD-M, and RSD-T, respectively. Otolith samples indicated 13 age classes of Walleye were present and ranged from 0 to 16 years old (Figure 18).

Walleye had a mean gonadal somatic index of 5 for males and 26 for females. Relative weights for each size class of Walleye were 84, 89, 98, 103, and 105% for stock, quality, preferred, memorable, and trophy sized Walleye, respectively. Relative weights of all female Walleye were 109% and relative weights of male Walleye were 96%. Mean visceral fat indices were 4 for males and 56 for female Walleye. Walleye annual mortality for combined sexes based on weighted catch curve analysis was 16 percent (Figure 18).

Males were 37% mature with females being only 28% mature. Age and length at 50% maturity for female Walleye were estimated at five years and 339 mm, respectively. Age and length at 50% maturity for male Walleye were two years and 302 mm, respectively. The overall FWIN ranking was 2.5 on a scale of 1-3, with 3 being optimal (Table 12).

## **DISCUSSION**

CPUE results in 2013 indicated that Walleye remain relatively abundant in SFCR. When compared to the 2008 FWIN sampling effort, the 2013 catch remained relatively constant (CPUE = 32-33) and was not statistically different based on overlapping confidence intervals. In most cases, the SFCR Walleye CPUE exceeds others reported for FWIN surveys in the United States, particularly Washington State, and in Canada. FWIN survey results from Washington State lakes and reservoirs were somewhat comparable, with an average CPUE of 19 (WDFW 2005), but were based on 24 hour soak times, whereas soak time in the 2013 SFCR FWIN sample was 21 hours. Recent Walleye surveys reported by Bolding (2008) and Schmuck (2011), in Washington State lakes and reservoirs conducted in 2008 and 2011 resulted in CPUE ranging from 4 - 32 fish/net for five sampled lakes. In contrast, CPUE from FWIN surveys conducted throughout the provinces of Ontario and Alberta (Carruthers et.al 2008) ranged from 2.8 to 10.7 fish per net. Based on these comparisons, the Salmon Falls Creek Reservoir Walleye fishery is highly abundant. Catch per unit effort of Walleye  $\geq 450$  mm was 3 in 2013 on SFCR. In 2007, catch per unit effort of Walleye  $\geq 450$  mm was 8, and in 2008 catch per unit effort of Walleye  $\geq 450$  mm was 7. Fewer large Walleye were caught in the 2013 sampling event.

Proportional stock density of the 2013 FWIN sample was 96, 14, 5, 3, and  $<1$ , for stock, quality, preferred, memorable, and trophy, respectively. During a three-year (2006-2008) survey, Ryan et al. (2008) reported PSD for stock, quality, preferred, memorable, and trophy of 89, 49, 12, 7, and 2, respectively (Figure 19). Our 2013 data suggests fewer Walleye in most size categories from quality and above. The SFCR Walleye fishery is dominated by stock- and quality-sized fish, with few larger fish present. Surveys in 2007 showed much more desirable PSDs compared to those observed in the 2013.

Walleye relative weights were generally below average, but increased with length (Figure 20). This suggests smaller Walleye (sub-stock, stock, and quality sized) are somewhat forage or gape limited, but this limitation is overcome as they achieve larger sizes (preferred, memorable, and trophy sized) and are able to consume larger forage. Interspecific competition with Yellow Perch, Northern Pike Minnow *Ptychocheilus oregonensis*, Smallmouth Bass, and larger trout species may exacerbate the intraspecific competition for food resources. Once Walleye reach memorable and trophy size, condition improves. In the 2013 sampling, larger fish seemed to have better relative condition, while smaller fish were below average relative weight. Relative weights of male Walleye remained the same in 2013 as compared to 2008, whereas relative weights of female Walleye increased slightly in 2013 compared to 2008. Visceral fat indices and gonadal somatic index both were comparable to sampling events in 2006-2008 reported by Ryan et al (2008). Both the visceral fat indices and gonadal somatic index decreased in the 2013 sampling event as compared to the 2008 sampling.

Length at age-3 decreased for both male and female Walleye in 2013 compared to the 2008 (Figure 21). Length of male Walleye at age-3 was 383 mm during 2008, compared to 310 mm at age-3 during 2013. Length of female Walleye at age-3 was 401 mm during 2008, compared to 339 mm at age-3 during 2013. Slower growth in the young Walleye as compared to previous

years could explain the decreasing length at age and the overall decreasing size structure in the SFCR Walleye population.

In conclusion, Walleye condition indices indicated Walleye are abundant and slightly below average condition. This population also appears to be experiencing slower growth than earlier surveys. While the FWIN benchmark classifications identified the SFCR Walleye population is between “healthy and stable” and “stressed and unstable” rankings (Table 13), it appears that the population may be showing signs of overabundance at smaller size classes and starting to become forage base limited due to interspecific and intraspecific competition. Another feasible explanation for decreased size structure could be increased harvest of larger-sized Walleye. Understanding angler total use and exploitation would be important to understanding whether larger-sized walleye are being over-exploited or whether poor growth conditions are not producing many large fish. Tagging Walleye greater than 230 mm (approximate minimum size of Walleye observed in past creel surveys) would help determine how anglers are utilizing the Walleye in the fishery. Also, conducting a standardized lowland lake survey is needed to determine how or if changes to the fish community have occurred. This would provide insight to how the forage base may have changed since the last standardized survey.

### **RECOMMENDATIONS**

1. Continue five-year rotational FWIN monitoring in 2018 to evaluate the relationship between Walleye catch rates and abundance to determine if Walleye production could be modeled and adaptive harvest management could be implemented.
2. Conduct a lowland lake survey to identify relative abundance and species composition of the entire fish community within SFCR.
3. Tag Walleye greater than 230 mm to determine angler use and exploitation within SFCR.

## SILVER CREEK TROUT POPULATION ASSESSMENT

### ABSTRACT

During 2013, we sampled Silver Creek and one of its primary tributaries, Stalker Creek, to estimate abundance of Brown Trout and Rainbow Trout and to assess population trends compared to previous surveys. We used electrofishing gear to sample trout from June 18, 2013 to June 27 in order to calculate mark-recapture estimates. A total of 1,310 Brown Trout, 1,453 Rainbow Trout, and 14 Brook Trout were sampled within the three sites. The estimated number of Rainbow Trout in the Lower Stalker Creek transect ( $\geq 100$  mm) was  $1,282 \pm 369$  (95% CI), which equated to 1,077 Rainbow Trout/ha. The estimated number of Brown Trout in the Lower Stalker Creek transect ( $\geq 100$  mm) was  $777 \pm 156$ , which equated to 653 Brown Trout/ha. The estimated number of Rainbow Trout in the Silver Creek Cabin transect ( $\geq 100$  mm) was  $5,757 \pm 1,714$ , which equated to 1,857 Rainbow Trout/ha. The estimated number of Brown Trout in the Silver Creek Cabin transect ( $\geq 100$  mm) was  $1,406 \pm 411$ , which equated to 453 Brown Trout/ha. Estimated number of Rainbow Trout in the Silver Creek Martin Bridge transect ( $\geq 100$  mm) was  $136 \pm 80$ , which equated to 89 Rainbow Trout/ha. Estimated number of Brown Trout in the Silver Creek Martin Bridge transect ( $\geq 100$  mm) was  $752 \pm 182$ , which equated to 494 Brown Trout/ha. While the numbers of trout in Silver Creek appeared to be relatively stable within the three sites sampled, the biomass appears to be shifting towards more Brown Trout in the Stalker Creek, Cabin, and Martin Bridge sites.

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## **INTRODUCTION**

Silver Creek is a tributary to the Little Wood River and is located in Blaine County, Idaho. Silver Creek is formed at the confluence of two main spring creek tributaries, Stalker and Grove creeks on the Nature Conservancy's Silver Creek Preserve (Figure 22). Silver Creek and its tributaries provide a popular, destination fishery for Rainbow and Brown Trout. Several regulation scenarios exist throughout the Silver Creek drainage allowing multiple angling opportunities including fly fishing only, catch and release; no bait, barbless hook, catch and release; bait allowed, none between 12 inches and 16 inches; and general rules.

The Silver Creek fishery, including its tributaries, has been the focus of several studies during the past 20 years including; monitoring Brown Trout and Rainbow Trout movements (Young et al. 1997), describing the fish community structure (Wilkison 1996), analyzing genetic population structure (Williams et al. 2000), and evaluating whirling disease presence (Spall et al. 1996). Standardized IDFG population monitoring transects and survey protocols were established in 2004. The entire Silver Creek drainage has also been the focus of numerous stream alteration projects in the last 15 years, and has been studied for thermal imaging, based on water temperature and its effects on cold water salmonids.

## **OBJECTIVE**

The overall objective of this study was to complete a standardized trout population monitoring survey in 2013, and to evaluate trends in trout population abundance and structure with those sampled in, 2004, 2007, and 2010.

## **METHODS**

During 2013, Silver and Stalker creeks were sampled at three sites to evaluate trends in population abundance and structure. Sites included lower Stalker Creek; Silver Creek, Cabin Site; and Silver Creek, Martin Bridge (Appendix A). Sampling was conducted using a drift-boat electrofishing setup (Appendix B). Fish were sampled on two runs, marking and recapturing, separated by seven days. Sampling was conducted during daylight hours on the lower Stalker Creek reach and during dark hours on the remaining two reaches.

Fish were identified, measured (TL), weighed (g), marked, and released during the first sampling run (i.e. marking). Weights were recorded only during the marking run. Caudal fin clips were used to mark Rainbow and Brown Trout equal or greater than 100 mm for identification in the recapture run. Other sampled species were not marked. Rainbow and Brown Trout were counted, measured, and observed for marks in the second run (i.e. recapture). Relative stock densities were estimated for all three sites. Relative stock densities (RSD-400) were determined for Rainbow Trout and Brown Trout collected in each transect to describe the preferred component of the fishery. RSD-400 was calculated as the number of fish  $\geq 400$  mm divided by the number of fish  $\geq 200$  mm (Ney 1993).

Rainbow Trout and Brown Trout abundances were estimated using a modified-Peterson, mark-recapture estimator (Ricker 1975). Estimates were calculated in 100 mm increments for fish equal to or greater than 100 mm total length. A minimum of five recaptures was required to complete estimates. Length groups with less than five recaptures were pooled. Abundance of Rainbow Trout and Brown Trout equal to or greater than 100 mm were estimated to allow

evaluation of long-term trends. Recapture efficiency,  $R_{eff}$ , was estimated as  $R_{eff} = R/C$ , where ( $R$ ) was the number of recaptures collected and ( $C$ ) was the total number of fish collected during the recapture run. Confidence intervals of 95% were generated for the estimates.

Marking run data were used to describe the sampled fish community and estimate population parameters. Estimated population parameters included relative stock density and relative weight. Relative stock densities (RSD-400) were determined for Rainbow Trout and Brown Trout sampled in each transect to describe the available preferred component of the fishery. RSD-400 was calculated as the number of fish  $\geq 400$  mm divided by the number of fish  $\geq 200$  mm (Ney 1993). Relative weight was calculated for Rainbow Trout and Brown Trout as a measure of fish condition and reported as mean relative weight by 100-mm length groups (Anderson and Neumann 1996, Simpkins and Hubert 1996). No age data was collected in this sampling event.

Habitat data was collected on a separate date following electrofishing efforts. Transect lengths and widths were measured with a Leica LRF 900 Rangemaster® rangefinder and or measuring tape at set intervals. Interval distance was chosen randomly. Transects waypoints were marked for future replication using a Magellan Sporttrack Topo Global Positioning System® (GPS; Appendix A).

## **RESULTS**

Silver Creek mark and recapture electrofishing surveys were completed from June 18, 2013 to June 27, 2013. Habitat data was collected in July 2013. Transect length at the lower Stalker Creek, Silver Creek Cabin, and Silver Creek Martin Bridge sites were 1,400 m, 1,150 m, and 1,100 m, respectively. Mean transect widths at the lower Stalker Creek, Silver Creek - Cabin Site, and Silver Creek - Martin Bridge locations were 8.5 m, 27.4 m, and 15.6 m, respectively.

### **Lower Stalker Creek**

Fish sampled in the Stalker Creek transect included wild Rainbow Trout ( $n = 439$ ), Brown Trout ( $n = 479$ ), and Brook Trout ( $n = 14$ ). A total of 202 and 239 Rainbow Trout were sampled in the Lower Stalker Creek transect during the marking and recapture runs, respectively. The estimated number of Rainbow Trout in the sample reach ( $\geq 100$  mm) was  $1,282 \pm 369$  (Table 14), which equated to 1,077 Rainbow Trout/ha. Recapture efficiency was 15%, for all length groups combined. Total length of sampled Rainbow Trout ranged from 95 to 420 mm TL (Figure 23). Weight of sampled Rainbow Trout ranged from 12 to 728 g.

A total of 190 and 288 Brown Trout were sampled in the Lower Stalker Creek transect during the marking and recapture runs, respectively. The estimated number of Brown Trout in the sample reach ( $\geq 100$  mm) was  $777 \pm 156$ , which equated to 653 Brown Trout/ha (Table 14). Recapture efficiency was 24%, across all length groups. Total length of sampled Brown Trout ranged from 95 to 610 mm (Figure 24). Relative stock density (RSD-400) was 31%. Total weight of sampled Brown Trout ranged from 12 to 2,112 g.

### **Silver Creek – Cabin Transect**

Fish sampled in the Silver Creek Cabin transect included wild Rainbow Trout ( $n = 948$ ), and Brown Trout ( $n = 456$ ). A total of 441 and 507 Rainbow Trout were sampled in the Silver Creek Cabin transect during the marking and recapture runs respectively. The estimated number of Rainbow Trout in the sample reach ( $\geq 100$  mm) was  $5,757 \pm 1,714$ , which equated to 1,857 Rainbow Trout/ha (Table 14). Recapture efficiency was 7.4%, for all length groups combined. Total length of sampled Rainbow Trout ranged from 25 to 500 mm TL (Figure 25). Relative stock density (RSD-400) was 6%. Weight of sampled Rainbow Trout ranged from 5 to 1,193 g.

A total of 214 and 241 Brown Trout were sampled in the Silver Creek Cabin transect during the marking and recapture runs, respectively. The estimated number of Brown Trout in the sample reach ( $\geq 100$  mm) was  $1,406 \pm 411$ , which equated to 453 Brown Trout/ha (Table 14). Recapture efficiency was 15%, for all length groups combined. Weight of sampled Brown Trout ranged from 5 to 2,732 g. Total length of sampled Brown Trout ranged from 20 to 630 mm (Figure 26). Relative stock density (RSD-400) was 9%.

### **Silver Creek – Martin Bridge Transect**

Fish sampled in the Silver Creek Martin Bridge transect included wild Rainbow Trout ( $n = 66$ ), and Brown Trout ( $n = 375$ ). A total of 37 and 24 Rainbow Trout were sampled in the Silver Creek Martin Bridge transect during the marking and recapture runs, respectively. Estimated number of Rainbow Trout in the sample reach ( $\geq 100$  mm) was  $136 \pm 80$ , which equated to 89 Rainbow Trout/ha. Recapture efficiency was 25%, for all length groups combined. Total length of sampled Rainbow Trout ranged from 110 to 410 mm (Figure 27). Weight of sampled Rainbow Trout ranged from 13 to 698 g. Relative stock density (RSD-400) was 4%.

A total of 202 and 173 Brown Trout were sampled in the Silver Creek Martin Bridge transect during the marking and recapture runs, respectively. Estimated number of Brown Trout in the sample reach ( $\geq 100$  mm) was  $752 \pm 182$ , which equated to 494 Brown Trout/ha. Recapture efficiency 27%, for all length groups combined. Total length of sampled Brown Trout ranged from 55 to 580 mm (Figure 28). Relative stock density (RSD-400) was 14%. Weight of sampled Brown Trout ranged from 2 to 1,463 g.

Relative weights for Rainbow Trout sampled in all three sampling reaches were 95% for all trout. Larger Rainbow Trout in the Stalker section were noticeably below 100%. Relative weight for Rainbow Trout in the Stalker section was 89%. Relative weight for Rainbow Trout in the Cabin Section was 96%. Relative weight for Rainbow Trout in the Martin Bridge section was 102% (Figure 29). Relative weights for Brown Trout sampled in all three sampling reaches were 101% for all trout. Relative weight of larger Brown Trout in the Stalker and Martin Bridge sections were noticeably below 100%. Relative weight for Brown Trout in the Stalker section was 93%. Relative weight for Brown Trout in the Cabin section was 99%. Relative weight for Brown Trout in the Martin Bridge section was 105% (Figure 30).

## **DISCUSSION**

Population estimates for Rainbow and Brown Trout have increased compared to the previous survey (2010) and were higher than for all previous sampling years, except 2001, since standardized sampling began. Estimates for 2001 still represent the high point for most

abundance estimates with the exception of the Martin Bridge site. The Martin Bridge site has had the lowest abundances within all sampling years when compared to the other sites. In the Stalker Creek site, Rainbow Trout densities showed a very slight increase from 2010, whereas in the Silver Creek - Cabin site, Rainbow Trout abundance increased by more than 5.5-fold compared to 2010. For the first time since standardized sampling began a Rainbow Trout population estimate was calculated on the Martin Bridge sampling section of Silver Creek, due to sufficient recaptures. The density at the Martin Bridge section was calculated as 162 Rainbow Trout per kilometer (Table 15). Overall densities of Brown Trout increased in all three sites of Stalker and Silver Creek in 2013 compared to 2010 (Table 15). Brown Trout represented 38%, 20%, and 85% of the trout sampled at Stalker, Cabin, and Martin sites, respectively.

Trends in relative stock densities (RSD-400) have been measured since 2001. Relative stock densities (RSD-400) for Rainbow Trout showed a decrease in the Stalker Creek sampling as compared to 2010. Relative stock densities (RSD-400) for Rainbow Trout showed an increasing trend in both the Cabin and Martin Bridge sampling sections as compared to the 2010 (Figure 31). Relative stock densities (RSD-400) for Brown Trout showed an increase in the Stalker Creek site compared to 2010. Relative stock densities (RSD-400) for Brown Trout showed a decreasing trend in both the Cabin and Martin Bridge sampling sections as compared to the 2010 (Figure 31).

Overall, the numbers of trout in Silver Creek have increased compared to the last several years. For the most part, RBT are the most numerous trout species in two of the three sample sites. Brown Trout are more numerous in the remaining (i.e. lower site).

### **RECOMMENDATIONS**

1. Maintain consistent trend monitoring surveys during early- to mid-June at sites established during 2001.
2. Assess the need for additional sites to more fully encompass the full range of habitats available for trout.
3. Maintain active involvement with habitat improvement projects being proposed and implemented on Silver Creek and its tributaries.





Figure 1. Satellite image of Filer Ponds complex (Google maps). Top is north



Figure 2. Satellite image of Oster Lake #1. Top is north





Figure 3. Satellite image of Riley Creek Pond (Google maps). Top is north.



Figure 4. Satellite image of the Oster Lakes complex (Google maps). Top is north





Figure 5. Bickel Ditch inflow (denoted by white line) into Oster pond 1, and the water delivery to the entire Oster Ponds complex.

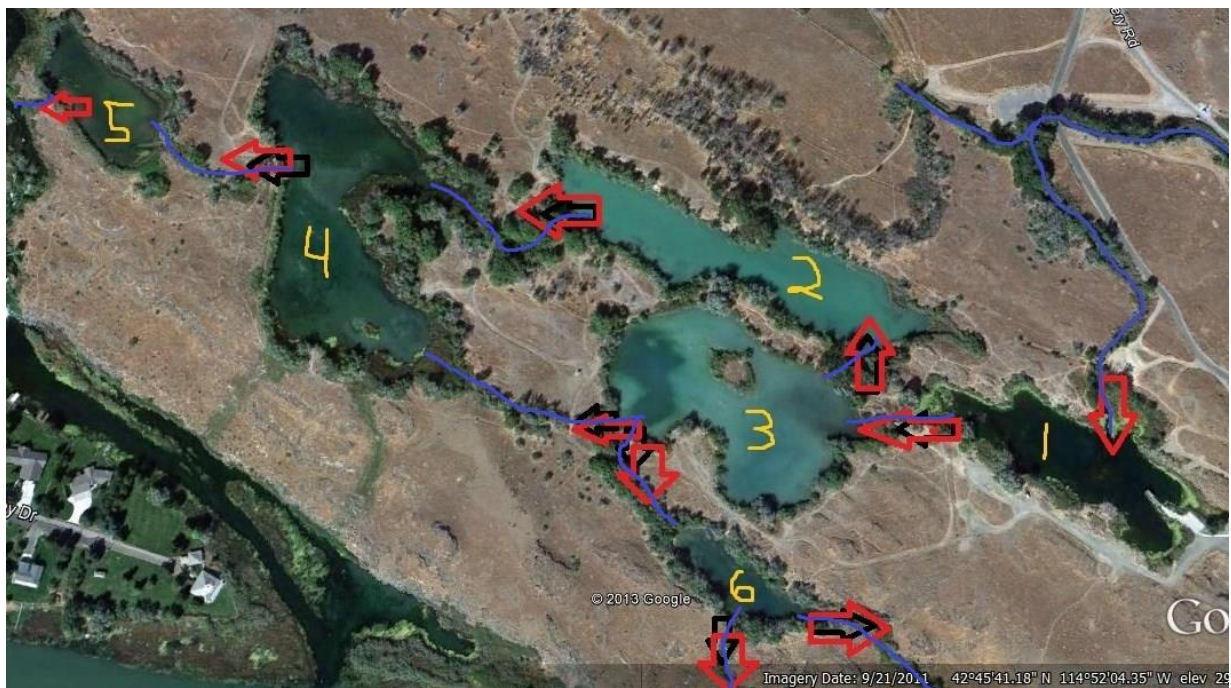


Figure 6. Hagerman Wildlife Management Area. Arrows denote water flow and control structures.





Figure 7. Post draw-down pools in Oster ponds 2, 3, 4, 5, and 6. Areas circled in white indicate isolated pools of water intended to be treated with piscicide.



Figure 8. Location of steel barriers (white) put in between Oster ponds 1 and 3 on the Hagerman WMA in fall 2013.

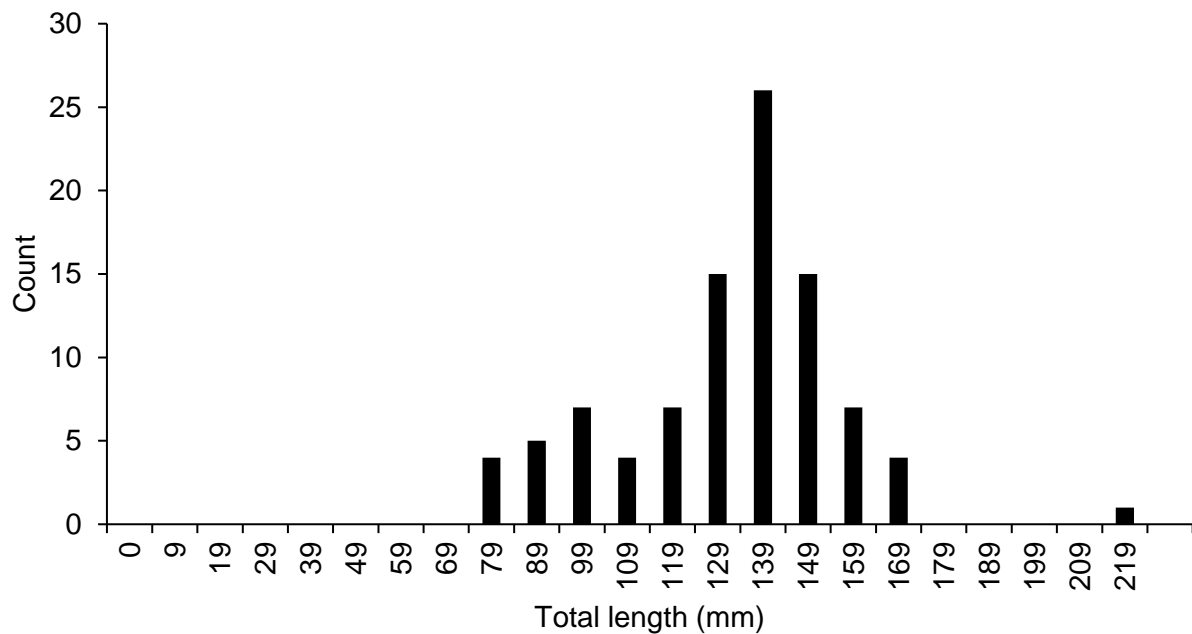


Figure 9. Length-frequency histogram of subsample ( $n = 100$ ) for Bluegill re-stocked into Oster lakes 2-6, via trap nets.

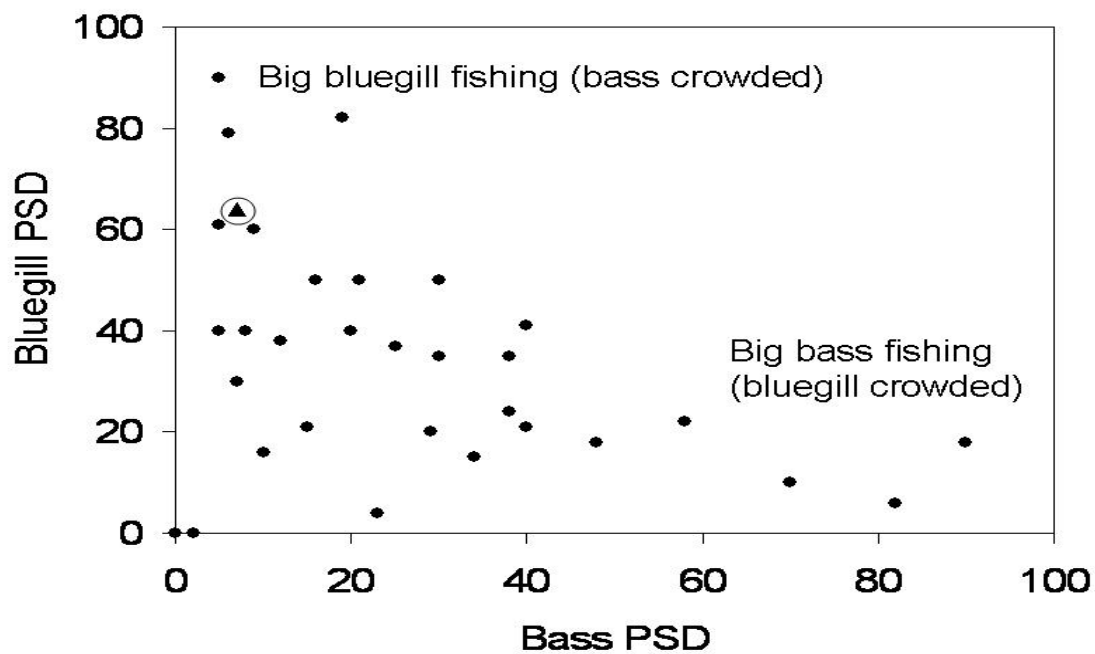


Figure 10. Plot of Bluegill PSD versus bass PSD for many ponds in northern Pennsylvania. each dot represents a separate pond (Soderberg et al 1995.).



Figure 11. Satellite image of Lower Salmon Falls Reservoir (Google maps). Top is north.

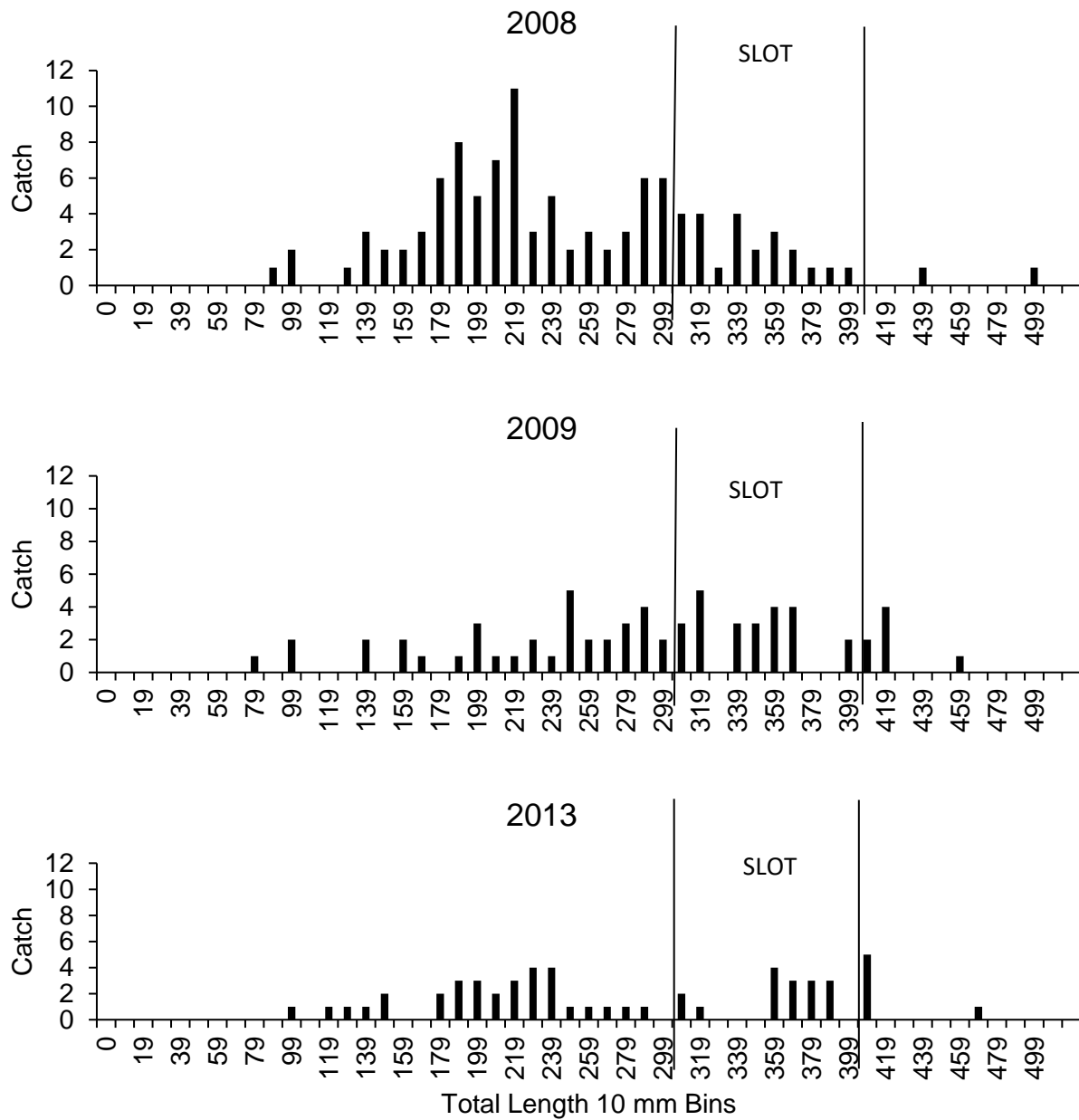


Figure 12. Length-frequency histograms for Largemouth Bass sampled on Lower Salmon Falls Reservoir in 2008 ( $n = 75$ ), 2009 ( $n = 66$ ), and 2013 ( $n = 54$ ) via electrofishing. Vertical lines represent upper and lower bounds of protective slot limit.

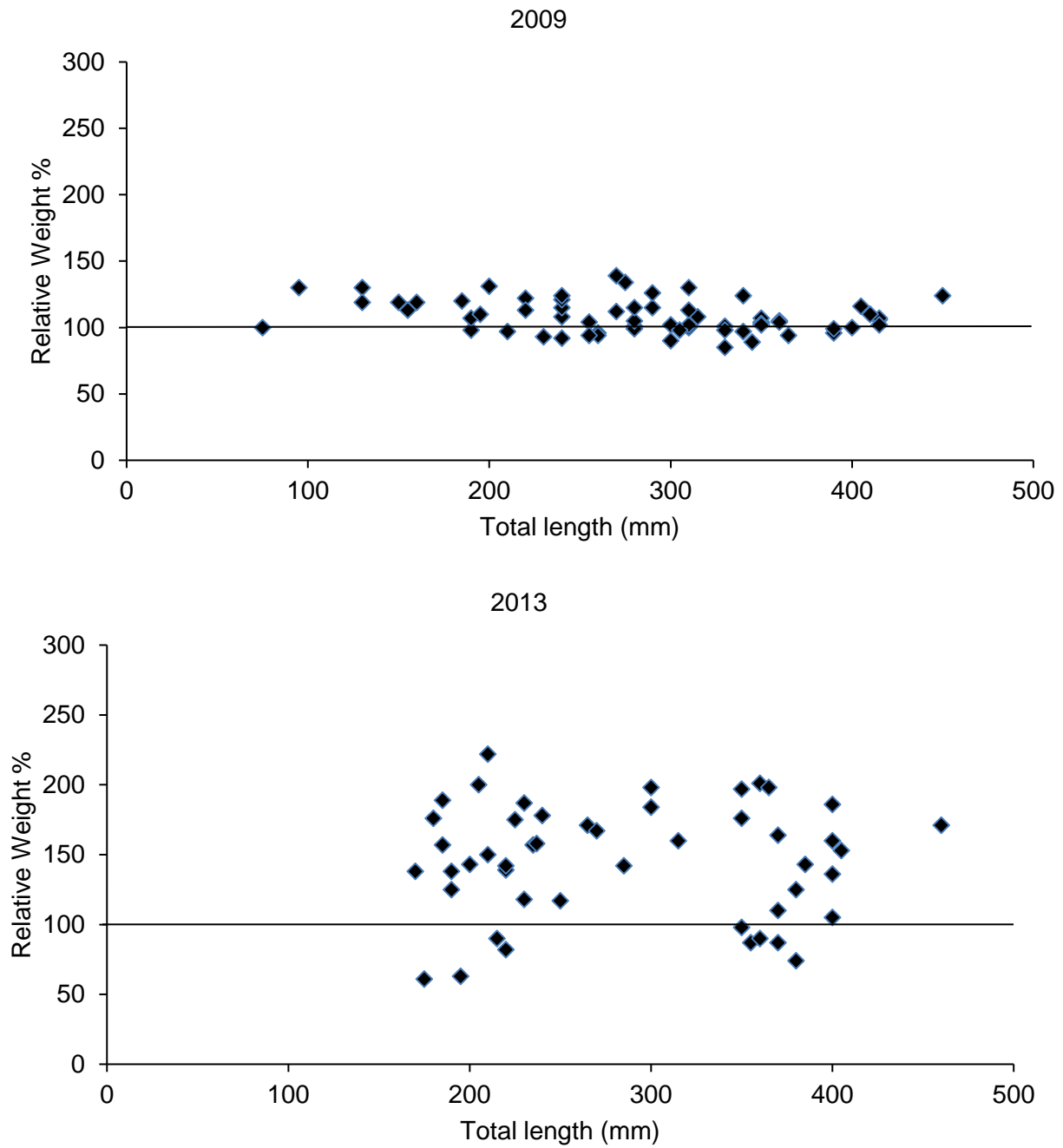


Figure 13. Relative weight comparisons for Largemouth Bass sampled on Lower Salmon Falls Reservoir in 2009 ( $n = 66$ ), and 2013 ( $n = 48$ ), via electrofishing.



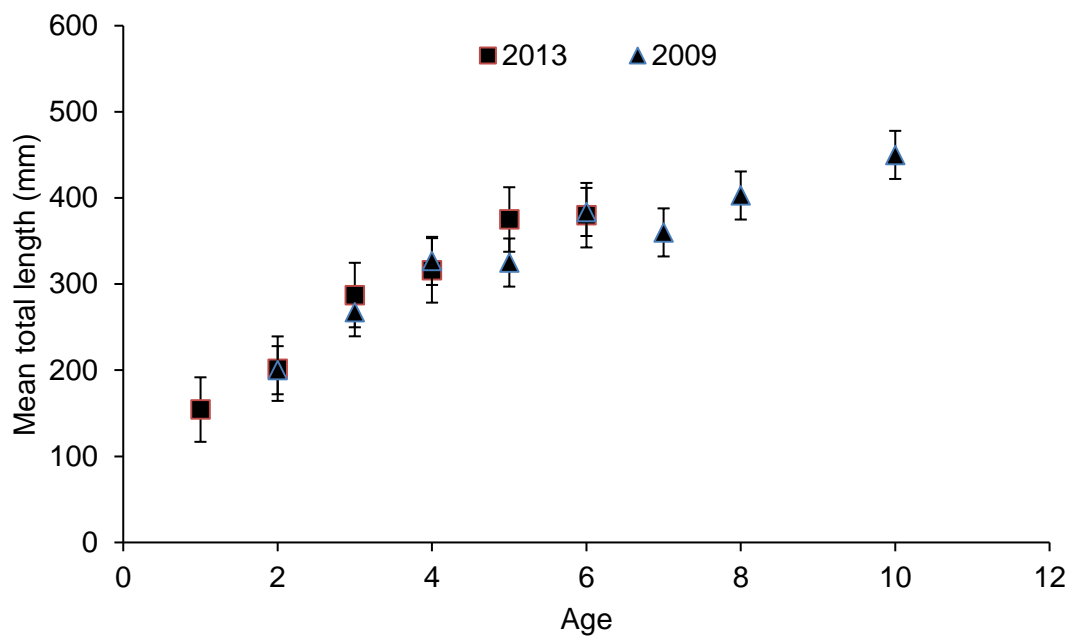


Figure 14. Mean length-at-age of Largemouth Bass from Lower Salmon Falls Reservoir sampled in 2009 ( $n = 66$ ) and 2013 ( $n = 54$ ), via electrofishing.

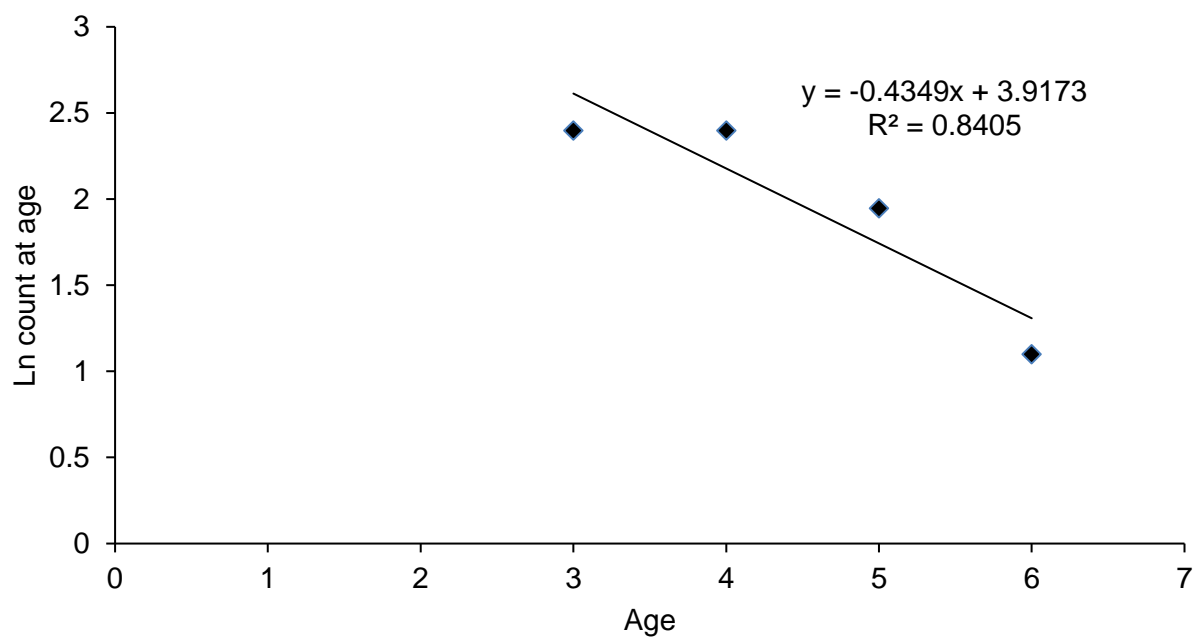


Figure 15. Catch curve for age-3 to -6 Largemouth Bass ( $n = 32$ ) sampled from Lower Salmon Falls Reservoir in 2013, via electrofishing.

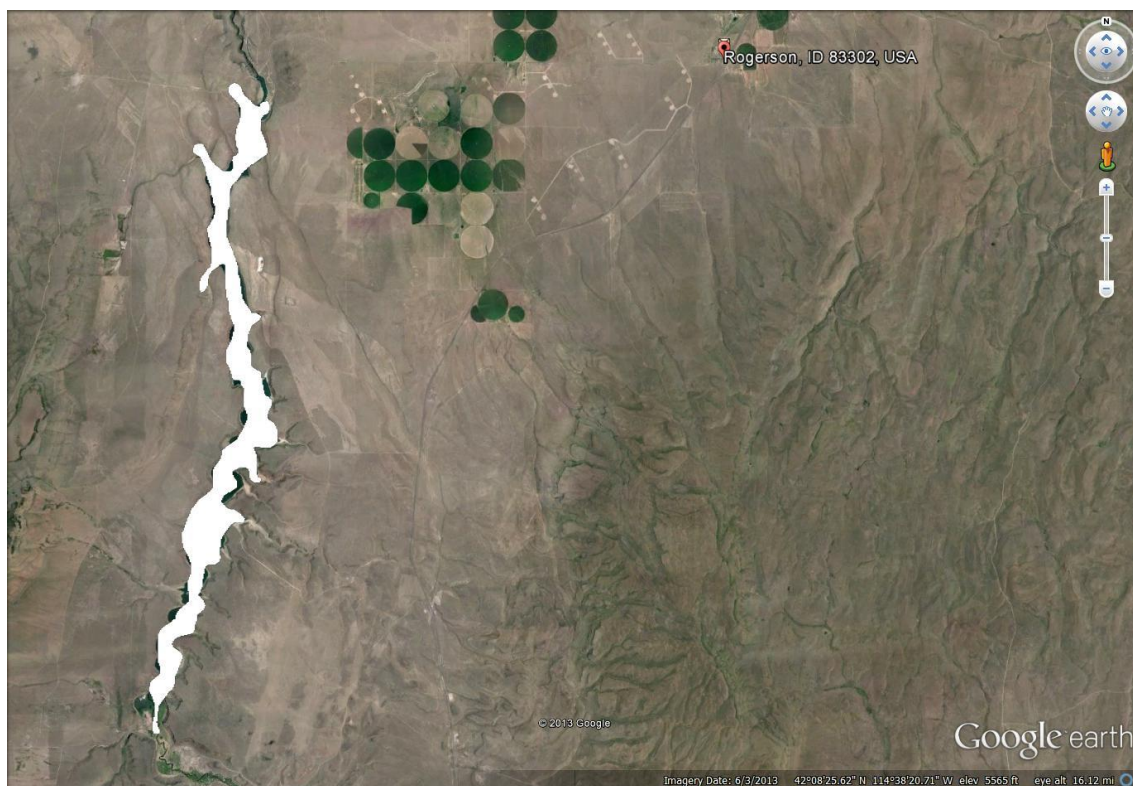


Figure 16. Satellite image of Salmon Falls Creek Reservoir (Google maps). Top is north.

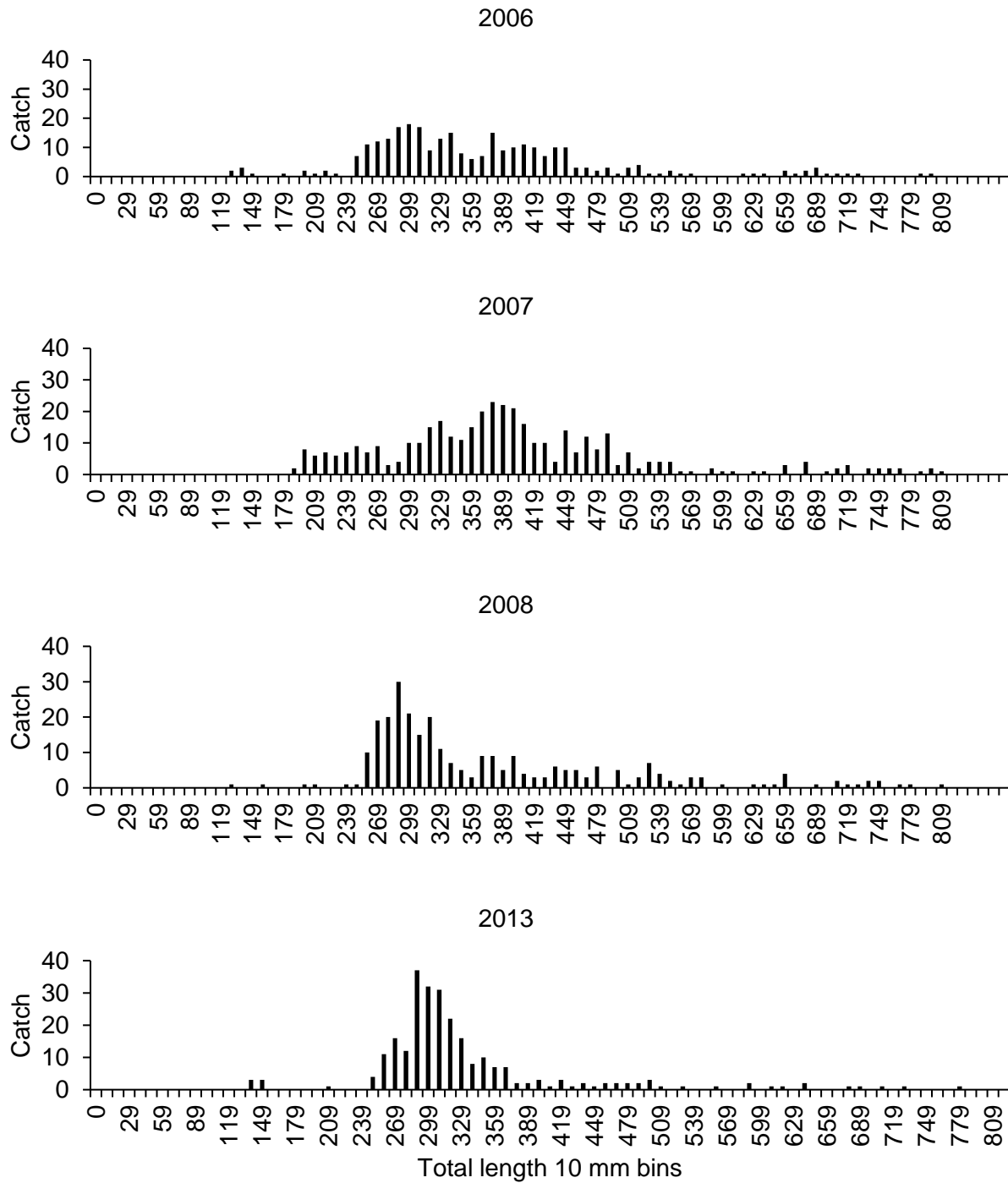


Figure 17. Comparative length-frequency histograms for Walleye sampled on Salmon Falls Creek Reservoir in 2006 ( $n = 292$ ), 2007 ( $n = 395$ ), 2008 ( $n = 288$ ), and 2013 ( $n = 260$ ) via gill nets.

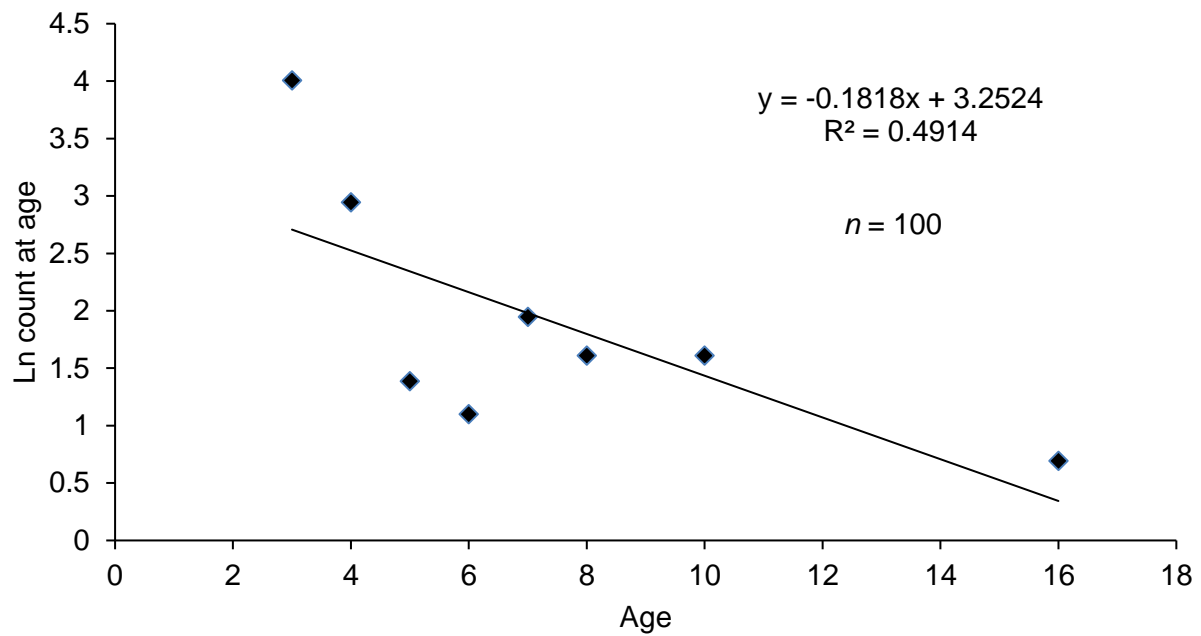


Figure 18. Catch curve for Walleye ages 3-16 sampled from Salmon Falls Creek Reservoir in 2013, via gill nets.

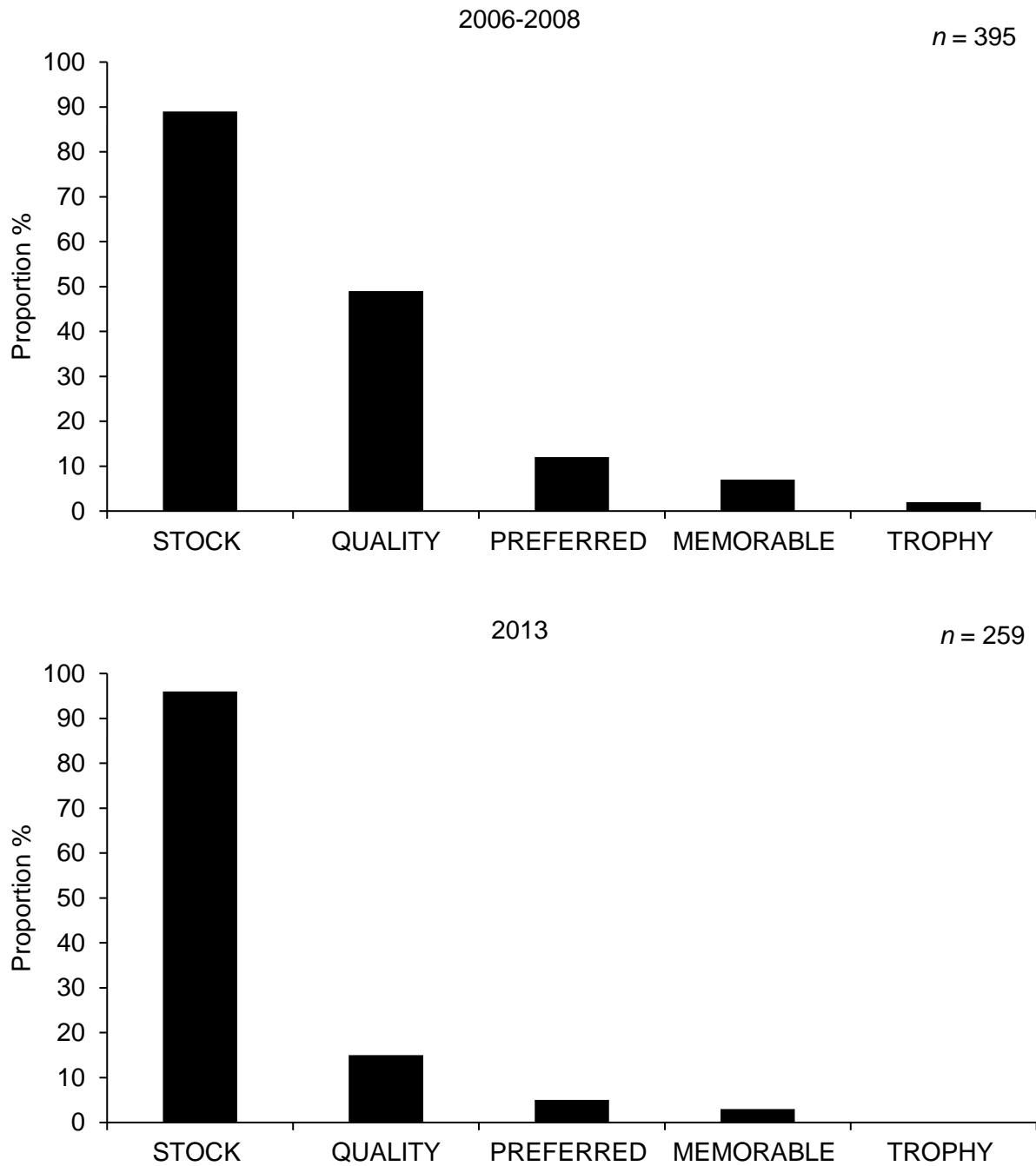


Figure 19. Proportional stock densities of Walleye per stock size sampled in Salmon Falls Creek Reservoir in 2006-2008 and 2013 via gill nets.

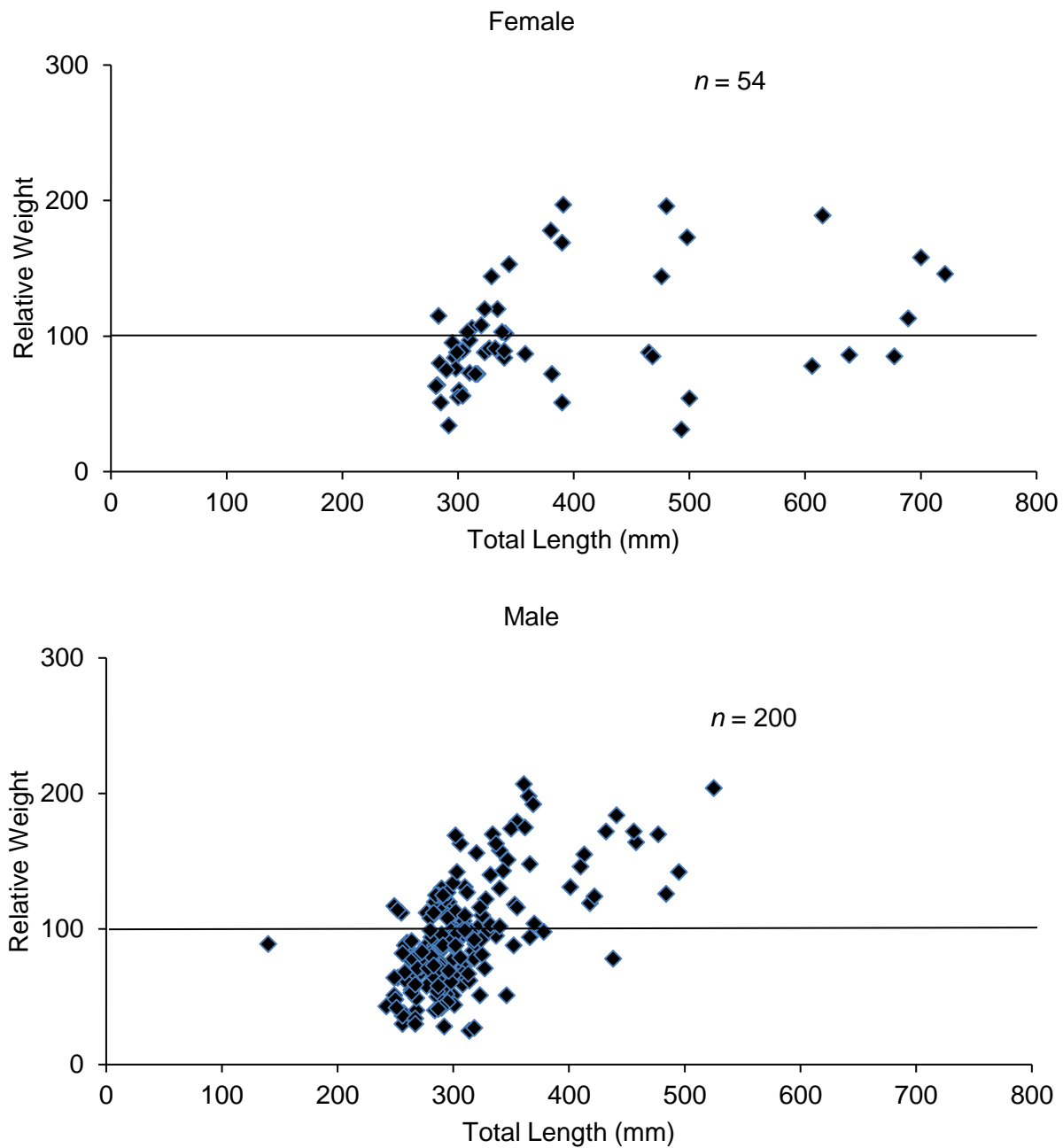


Figure 20. Relative weight of female (top) and male (bottom) Walleye sampled in Salmon Falls Creek Reservoir in 2013 via gill nets.

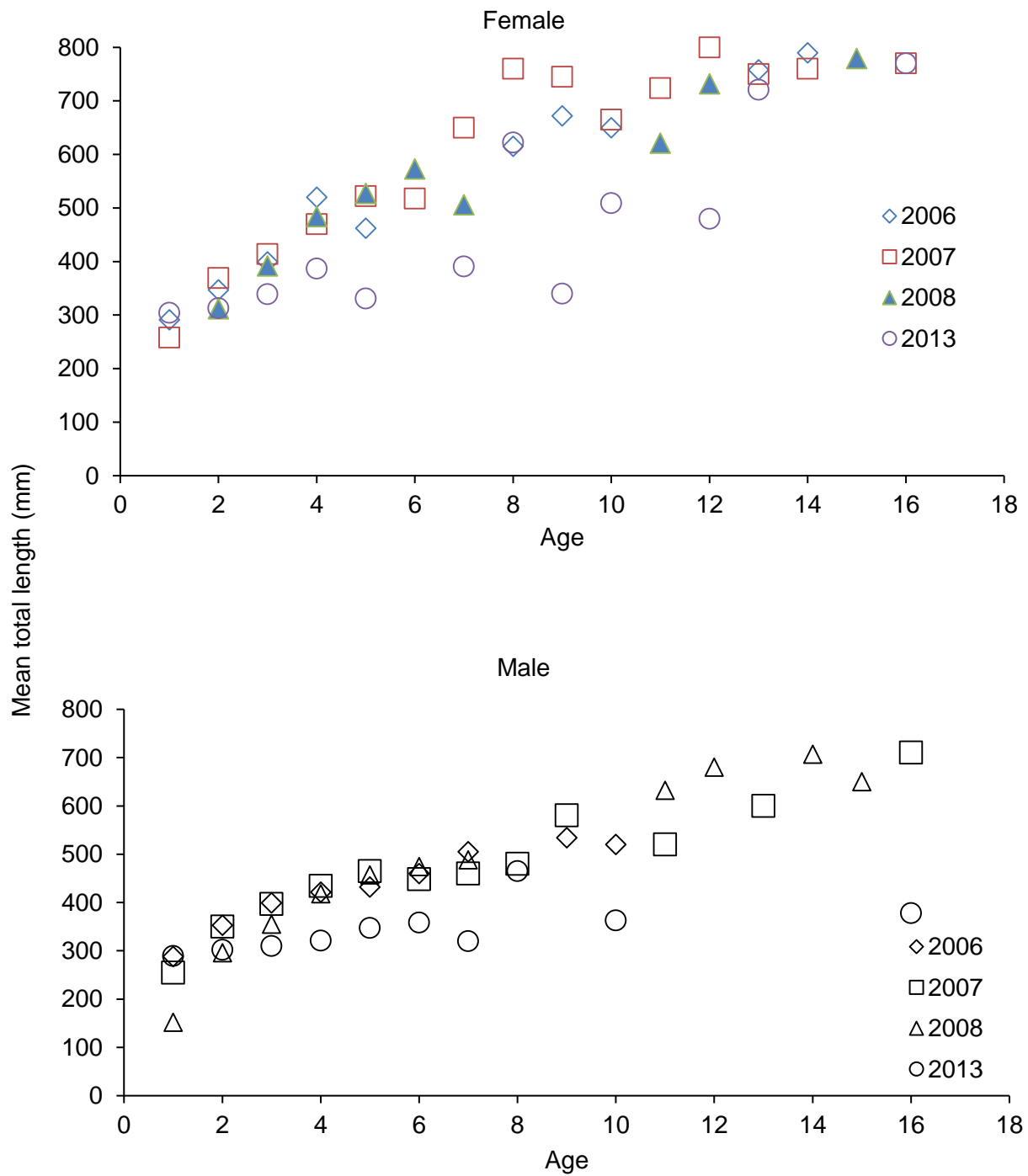


Figure 21. Mean length at age of male and female Walleye sampled in Salmon Falls Creek Reservoir in 2006, 2007, 2008, and 2013 via gill nets.

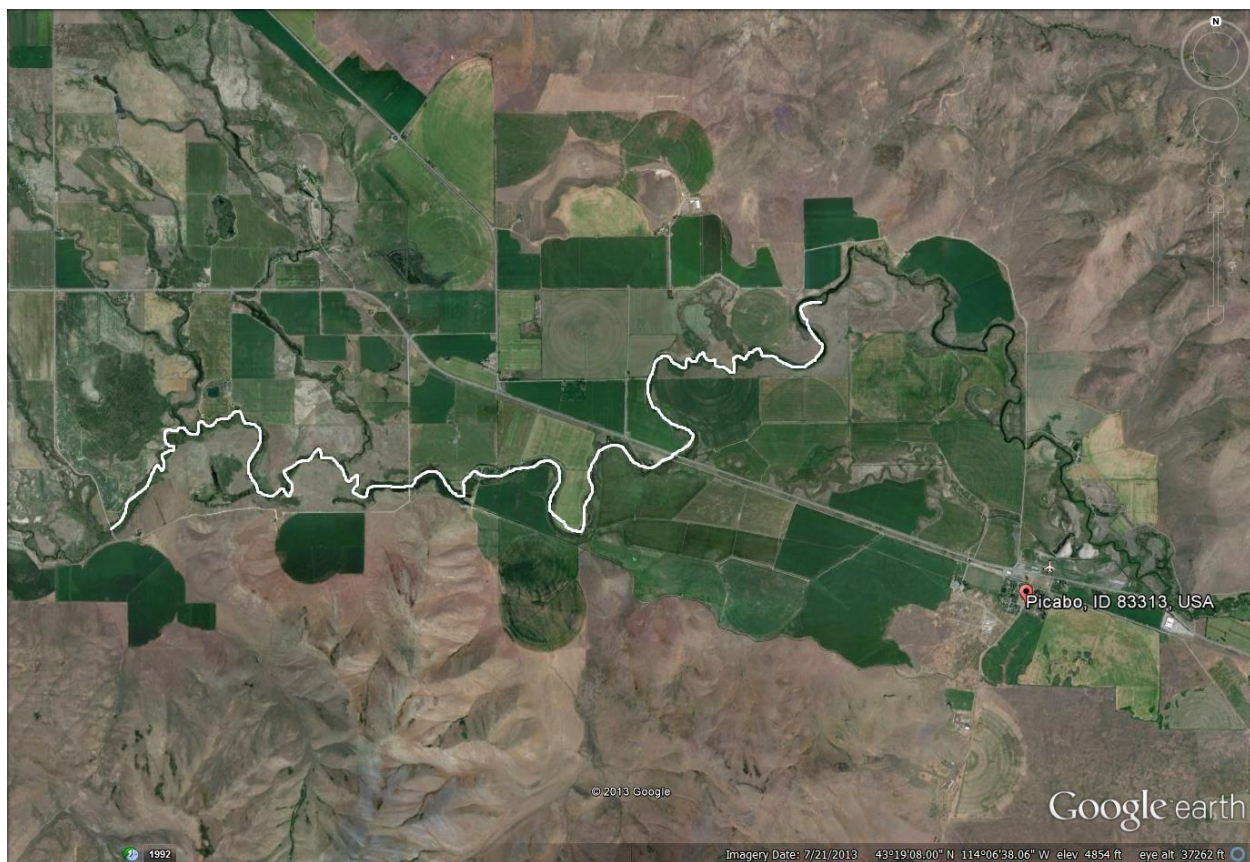


Figure 22. Satellite image of Silver Creek (Google maps). Top is north.



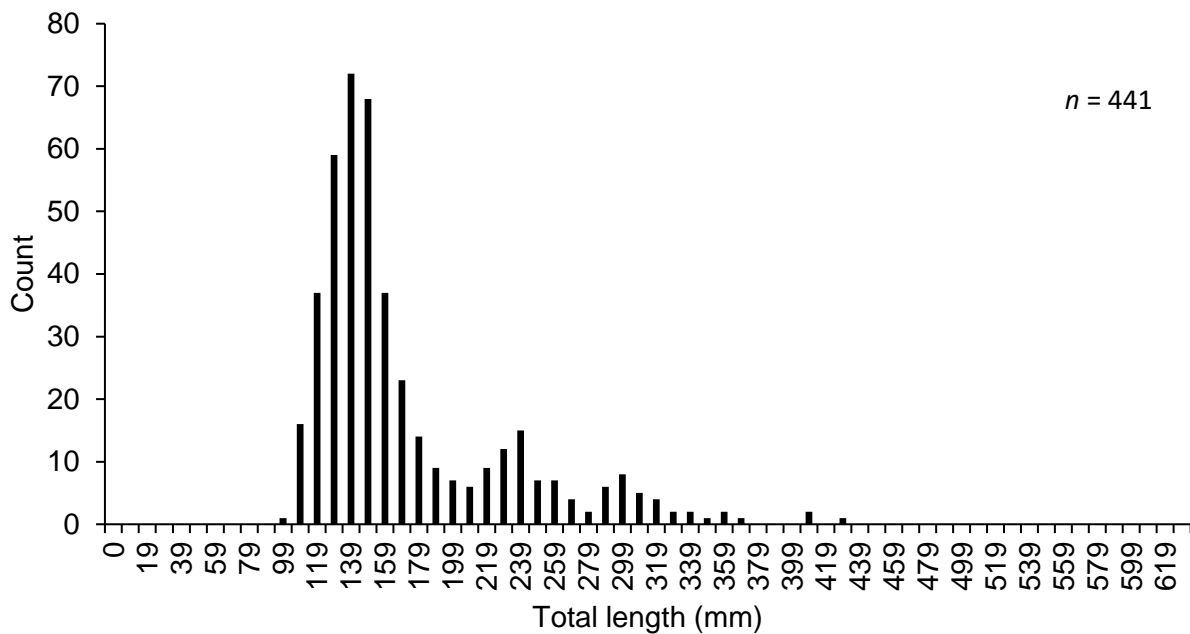


Figure 23. Length-frequency histogram of Rainbow Trout sampled in Stalker creek in 2013 via electrofishing.

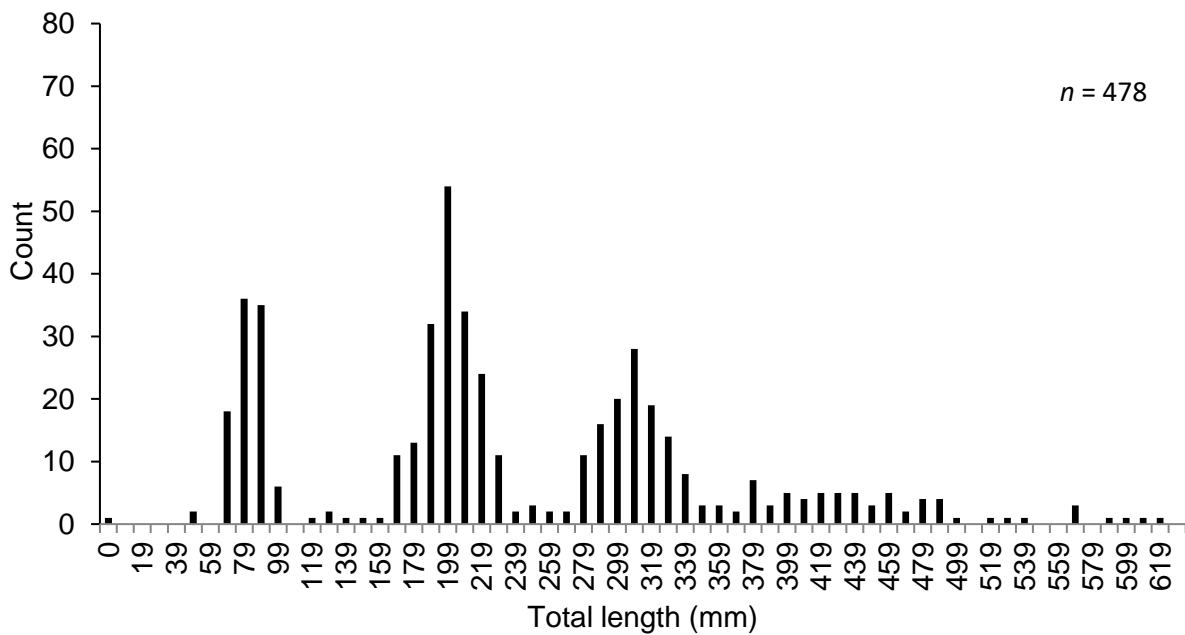


Figure 24. Length-frequency histogram of Brown Trout sampled in Stalker creek in 2013 via electrofishing.

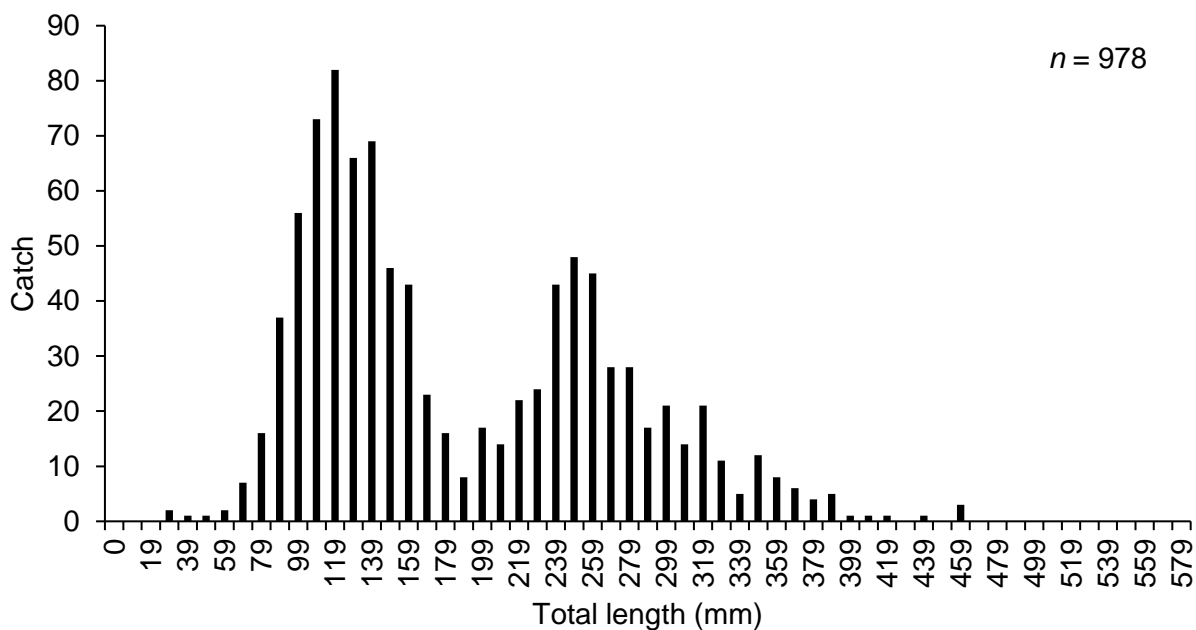


Figure 25. Length-frequency histogram of Rainbow Trout sampled in Silver Creek (Cabin section) in 2013 via electrofishing.

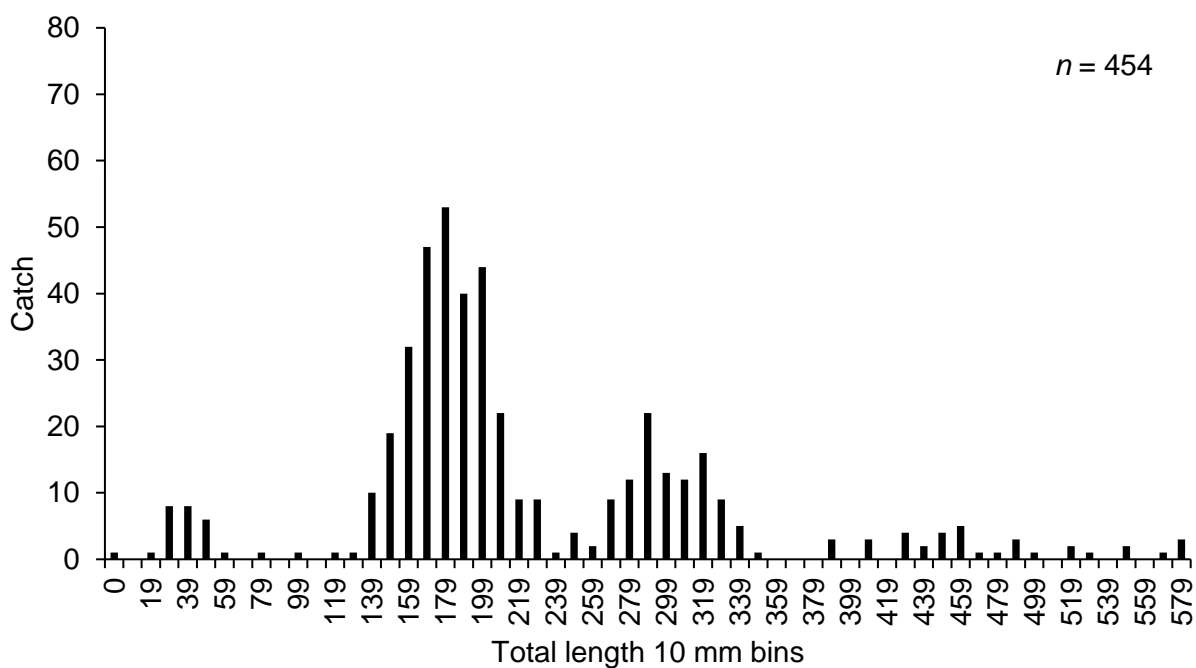


Figure 26. Length-frequency histogram of Brown Trout sampled in Silver Creek (Cabin section) in 2013 via electrofishing.

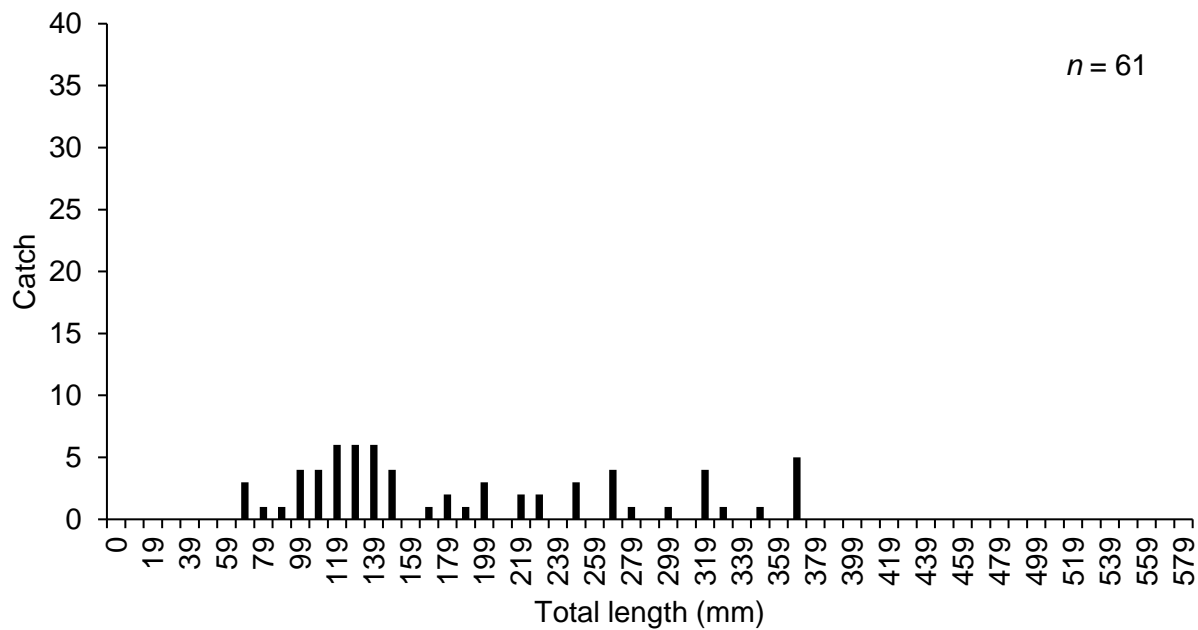


Figure 27. Length-frequency histogram of Rainbow Trout sampled in Silver Creek (Martin Bridge section) in 2013 via electrofishing.

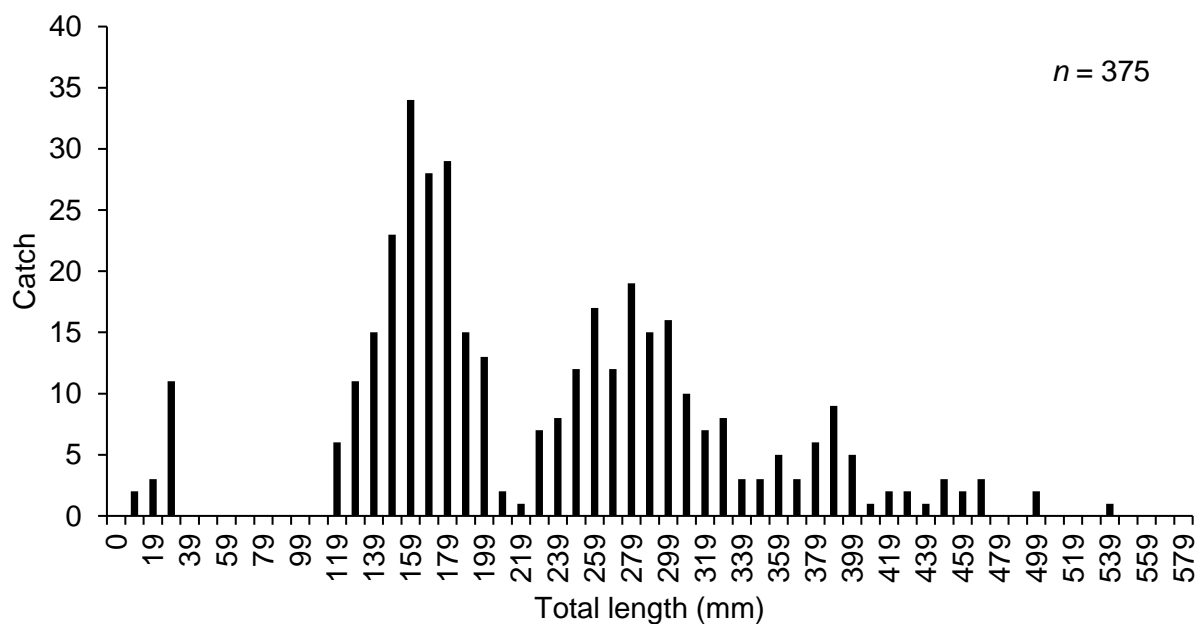


Figure 28. Length-frequency histogram of Brown Trout sampled in Silver Creek (Martin Bridge section) in 2013 via electrofishing.

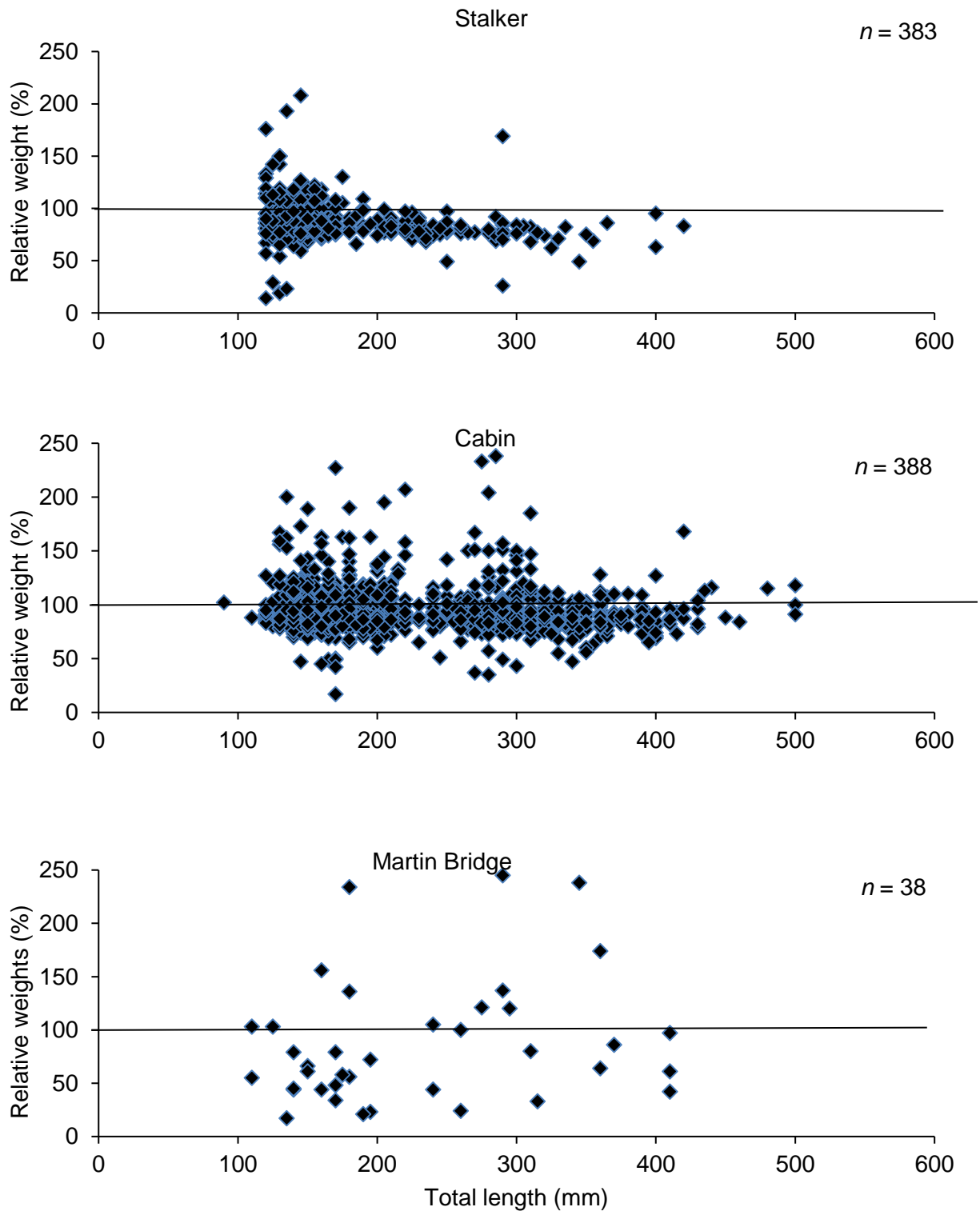


Figure 29. Relative weights of Rainbow Trout in three reaches sampled in Stalker Creek and Silver Creek in 2013, via electrofishing.

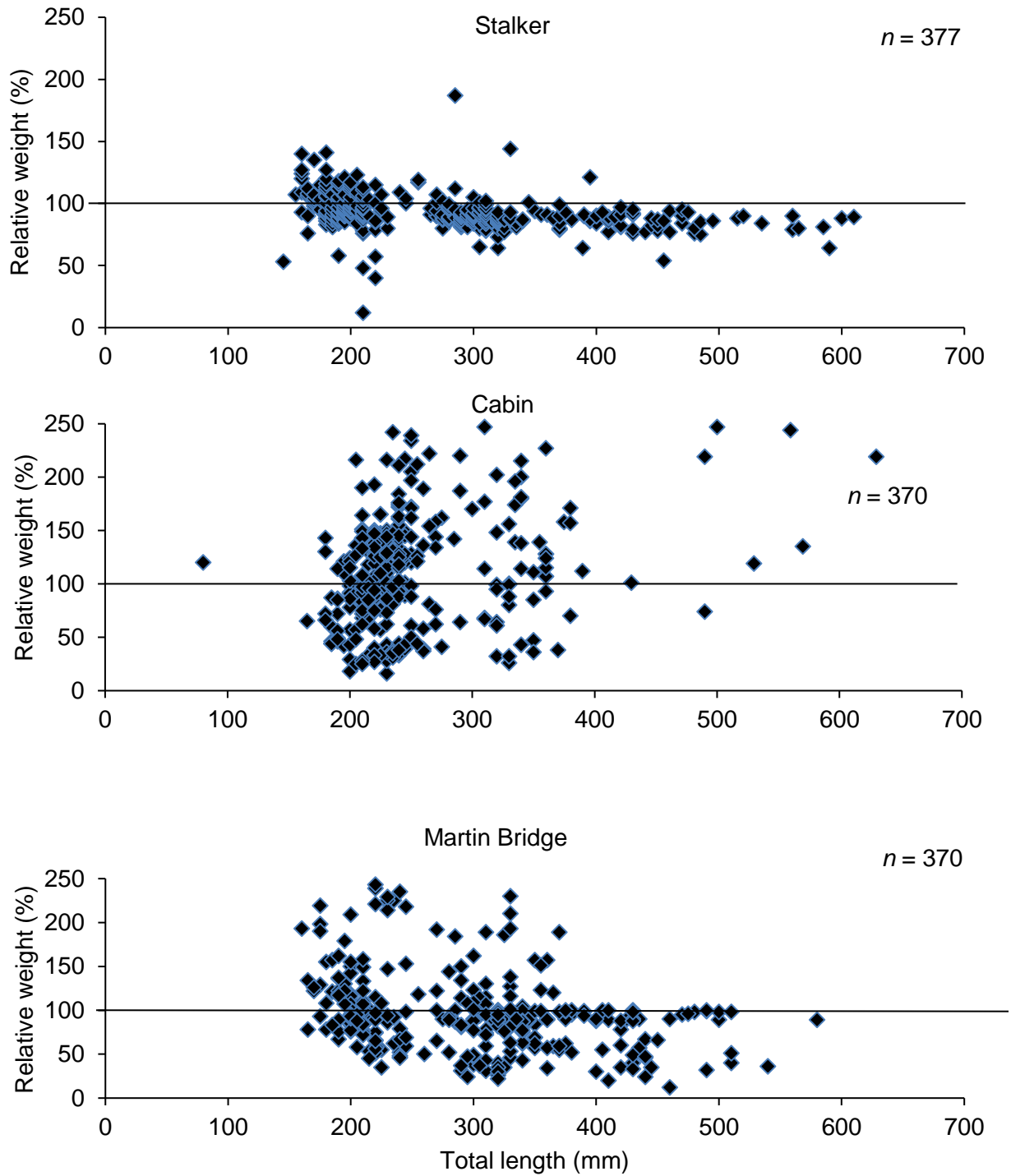


Figure 30. Relative weights of Brown Trout in three reaches sampled in Stalker Creek and Silver Creek in 2013, via electrofishing.

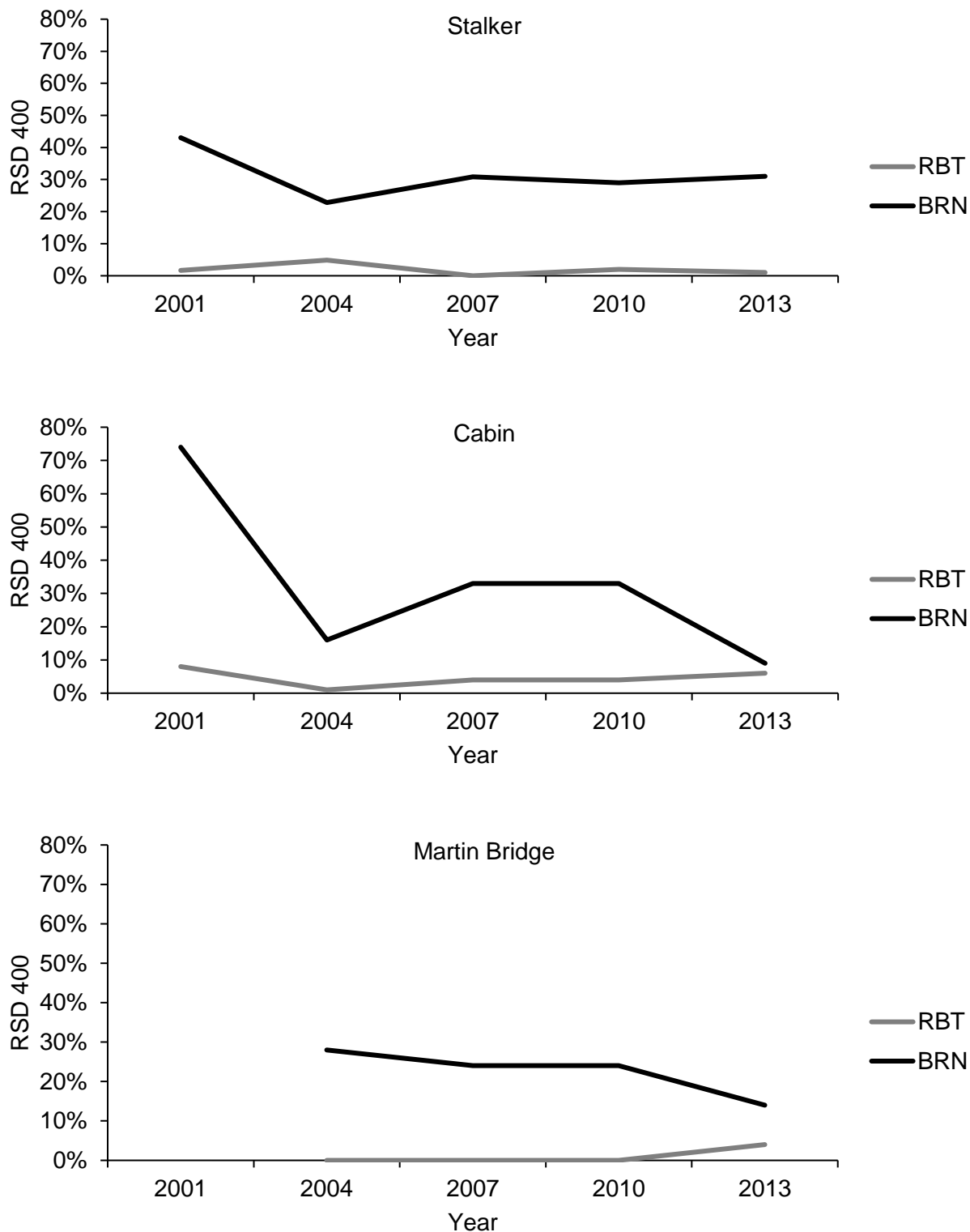


Figure 31. Relative stock density (RSD 400) of Rainbow and Brown Trout by survey transect and year in Stalker Creek and Silver Creek, Idaho.

Table 1. Estimated angler effort in Filer Pond, Idaho from May 18 to October 31, 2013 derived using randomized roving creel survey design.

	Effort Estimate	Lower Limit <sup>a</sup>	Upper Limit <sup>a</sup>
May	2,508	111	4,905
June	1,206	734	1,678
July	702	306	1,098
August	793	221	1,365
September	648	329	967
October	941	524	1,358
Total	6,798	2,223	11,373

<sup>a</sup>95% confidence limit

Table 2. Estimated angler catch, catch rate and harvest of hatchery Rainbow Trout from May 18 to October 31, 2013 in Filer Pond, Idaho.

Species	Catch			Harvest	
	Est (#)	CI <sup>a</sup>	Rate (#/h) <sup>b</sup>	Estimate (#)	CI <sup>a</sup>
Rainbow Trout	7,925	2,805	1.16	6,538	4,228

<sup>a</sup> 95 % confidence limit

<sup>b</sup> Based on the estimated catch and an estimated effort of h

Table 3. Estimated angler effort in Oster Pond 1, Idaho from May 19 to October 31, 2013 derived using randomized roving creel survey design.

	Effort Estimate	Lower Limit <sup>a</sup>	Upper Limit <sup>a</sup>
May	3,782	1,240	6,324
June	3,918	2,560	5,276
July	2,785	1,242	4,328
August	2,761	1,669	3,853
September	2,772	1,523	4,021
October	1,891	925	2,857
Total	17,909	9,160	26,658

<sup>a</sup>95% confidence limit

Table 4. Estimated angler catch, catch rate and harvest of hatchery Rainbow Trout from May 19 to October 31, 2013 in Oster Pond 1, Idaho.

Species	Catch			Harvest	
	Est (#)	CI <sup>a</sup>	Rate (#/h) <sup>b</sup>	Estimate (#)	CI <sup>a</sup>
Rainbow Trout	38,274	24,400	2.13	32,116	6,705

<sup>a</sup> 95 % confidence interval

<sup>b</sup> Based on the estimated catch and an estimated effort of h

Table 5. Estimated angler effort in Riley Pond, Idaho from May 19 to October 31, 2013 derived using randomized roving creel survey design. Estimates were generated using an average of 12 daylight hours per day.

	Effort Estimate	Lower Limit <sup>a</sup>	Upper Limit <sup>a</sup>
May	3,396	983	5,809
June	2,912	519	5,305
July	1,696	638	2,754
August	2,120	1244	2,996
September	811	368	1,254
October	426	122	730
Total	11,361	3,874	18,848

<sup>a</sup>95% Confidence limit

Table 6. Estimated angler catch, catch rate and harvest of hatchery Rainbow Trout from May 19 to October 31, 2013 in Riley Pond, Idaho.

Species	Catch			Harvest	
	Est (#)	CL <sup>a</sup>	Rate (#/h) <sup>b</sup>	Estimate (#)	CL <sup>a</sup>
Rainbow Trout	10,762	6,705	0.95	6,078	4,336

<sup>a</sup> 95 % confidence limit

<sup>b</sup> Based on the estimated catch and an estimated effort of h



Table 7. Rotenone application table for Oster ponds 2-6 treatment in 2013.

Rotenone application rate (2.5% active)	
Carp in organic rich environment	8 ppm
Active rotenone	0.25 ppm
Ac-ft treated/gal rotenone	0.38 ac-ft

Table 8. Locations and structure descriptions for water distribution on the Hagerman WMA, Oster Ponds in 2013 sampling.

Fishery	Pool ID	Measure	Estimate
Oster 2	Pool # 1	Avg. Width (m)	61
		Avg. Length (m)	287
		Avg. Depth (m)	1
		Hectare	2.2
		Total Liters of product	128
Oster 3	Pool #1	Width	65
		Length	80
		Depth	1
		Hectare	1
		Total Liters of product	25
Oster 3	Pool # 2	Avg. Width	59
		Avg. Length	79
		Avg. Depth	1
		Hectare	1
		Total Liters of product	24
Oster 4	Pool # 1	Width	62
		Length	146
		Depth	1
		Hectare	1.28
		Total Liters of product	57
Oster 5	Pool # 1	Width	45
		Length	22
		Depth	1
		Hectare	0.31
		Total Liters of product	7.5
Oster 6	Pool # 1	Width	10
		Length	100
		Depth	0.5
		Hectare	0.2
		Total Liters of product	3.7
		Total Hectare to be treated	6
		Total Liters of product	245

Table 8 (continued)

Location Description	Latitude Longitude	Structure
Ditch to Oster 1	42°45'41.32"N 114°51'50.03"W	Concrete checks/Boards
Oster 1 to Oster 3	42°45'34.57"N 114°51'55.35"W	Concrete checks/Boards
Oster 3 to Oster 2	42°45'35.46"N 114°51'58.24"W	Slide gate valve/tube
Oster 3 to Oster 4	42°45'33.91"N 114°52'5.49"W	Concrete checks/Boards
Oster 3 to Oster 6	42°45'33.91"N 114°52'5.49"W	Concrete checks/Boards
Oster 2 to Oster 4	42°45'39.79"N 114°52'7.60"W	Concrete checks/Boards
Oster 4 to Oster 5	42°45'40.71"N 114°52'17.84"W	Concrete checks/Boards
Oster 5 to Riley Creek	42°45'42.52"N 114°52'25.88"W	Concrete checks/Boards
Oster 6 to Snake River	42°45'29.68"N 114°51'57.99"W	no structure/overflow
Oster 6 to Snake River	42°45'29.49"N 114°52'1.55"W	no structure/overflow

Table 9. Full pool of restored fisheries, Oster ponds 2-6 in 2013 sampling.

Fishery	Mean length(m)	Mean width(m)	Ha
Oster 2	312	55	1.70
Oster 3	196	112	2.10
Oster 4	210	107	2.20
Oster 5	118	48	0.57
Oster 6	101	23	0.23

Table 10. Area in ha of each restored fishery at full pool volume, along with number of Bluegill and bass restocked in the fishery.

Fishery	Ha	Bluegill restock	LMB restock
Oster 2	1.70	420	105
Oster 3	2.10	540	135
Oster 4	2.20	550	137
Oster 5	0.57	140	35
Oster 6	0.23	58	14

Table 11. Long-term monitoring summaries from bass electrofishing surveys in the Magic Valley Region bass fisheries from 2008 through 2013.

Fishery	Species	Measure	Year					
			2008	2009	2010	2011	2012	2013
Anderson Ranch Res.	SMB	Ave. catch (CPUE)	20			34		
		Ave. length (mm)	198			167		
		Ave length at Age 5	280			237		
		PSD	36			22		
		RSD(S-Q)	64			78		
		Max. age (years)	6			11		
Bell Rapids Res.	LMB/SMB	Ave. catch (CPUE)	28	38				25
		Ave. length (mm)	244	277				226
		Ave length at Age 5	302	325				375
		PSD	33	56				55
		RSD(S-Q)	67	44				45
		Max. age (years)	10	10				6
Milner Res.	SMB	Ave. catch (CPUE)		76		92		
		Ave. length (mm)		200		202		
		Ave length at Age 5		264		273		
		PSD		26		39		
		RSD(S-Q)		74		61		
		Max. age (years)		11		15		
Salmon Falls Cr. Res.	SMB	Ave. catch (CPUE)	240			128		
		Ave. length (mm)	185			168		
		Ave length at Age 5	220			226		
		PSD	33			21		
		RSD(S-Q)	67			79		
		Max. age (years)	7			9		
Lake Walcott	SMB	Ave. catch (CPUE)		124			150	
		Ave. length (mm)		160			176	
		Ave length at Age 5		387			331	
		PSD		45			53	
		RSD(S-Q)		55			47	
		Max. age (years)		13			12	
Magic Reservoir	SMB	Ave. catch (CPUE)			2		42	
		Ave. length (mm)			185		212	
		Ave length at Age 5					284	
		PSD			17		21	
		RSD(S-Q)			83		79	
		Max. age (years)			4		11	

Table 12. FWIN sampling indices from Salmon Falls Creek Reservoir 2006-2013, via gill nets.

Fishery	Measure	Year			
		2006	2007	2008	2013
Salmon Falls Creek Res.	Ave. catch (CPUE)	24	33	32	33
	Ave catch $\geq$ 450 mm	4	8	7	3
	Relative Weight (%) (M)	98	96	96	96
	Relative Weight (%) (F)	103	101	102	109
	Ave. VFI	3.38	3.32	3.1	1
	Ave. GSI	1.43	1.32	1.65	1.5
	Max. age in Sample	15	16	17	16
	Age classes present	16	16	12	13
	FWIN Score	2.5	2.75	3	2.5

Table 13. Fall Walleye Index Netting (FWIN), from Salmon Falls Creek Reservoir. Benchmark Classification Scoring Parameters for 2013 sampling via gill nets.

2013 Score		Benchmark classification	
Parameter	Value	Score	Note
CPUE $\geq$ 450	1.89	2	Geomean with > 1 in sample
Age Classes	13	3	
Maximum age	16	2	
Female Div. Index	1.17	3	
	Score	2.5	
Parameter rank	Healthy/stable	Stressed/unstable	Unhealthy/collapsed
Score	3	2	1
CPUE $\geq$ 450mm	$\geq 2/\text{net-1}$	$0.44 \text{ to } 1.99 \cdot \text{net-1}$	$\leq 0.43 \cdot \text{net-1}$
No. of age classes	$\geq 11$ age classes	6 to 10 age classes	$\leq 5$ age classes
Maximum age	>16 years	14 to 16 years	$\leq 13$ years
Shannon Div. Index	$\geq 0.66$	0.56 to 0.65	$\leq 0.55$

Table 14. Comparative population estimates over the three reaches sampled in Silver Creek from 2001-2013.

Species	Site	Year	Size class	Pop est.
Rainbow Trout	Stalker	2001	100 - 499 mm	877
		2004	>100 mm	801
		2007	100 - 499 mm	768
		2010	100 - 499 mm	1,227
		2013	100 - 499 mm	1,282
	Cabin	2001	≥ 100 mm	7,483
		2004	≥ 100 mm	3,433
		2007	100 - 499 mm	2,054
		2010	100 - 499 mm	1,059
		2013	100 - 599 mm	5,757
	Martin	2001		
		2004		
		2007		
		2010		
		2013	≥ 100 mm	136
Brown Trout	Stalker	2001	100 - 699 mm	1,827
		2004	> 100 mm	439
		2007	100 - 699 mm	324
		2010	100 - 699 mm	461
		2013	100 - 699 mm	777
	Cabin	2001	≥ 100 mm	2,997
		2004	≥ 100 mm	1,727
		2007	100 - 699 mm	366
		2010	100 - 699 mm	457
		2013	100 - 699 mm	1,406
	Martin	2001	100-300 mm	627
		2004	100-300 mm	797
		2007	100 - 699 mm	538
		2013	100 - 699 mm	752

Table 15. Comparative linear density estimates over the three reaches of Silver Creek sampled from 2001-2013.

Species	Site	Year	Size class	#/km
Rainbow Trout	Stalker	2001	100 - 499 mm	1,070
		2004	>100 mm	666
		2007	100 - 499 mm	966
		2010	100 - 499 mm	1,686
		2013	100 - 499 mm	929
	Cabin	2001	≥ 100 mm	6,236
		2004	≥ 100 mm	4,286
		2007	100 - 499 mm	1,726
		2010	100 - 499 mm	910
		2013	100 - 599 mm	5,050
	Martin	2001		
		2004		
		2007		
		2010		
		2013	100 - 499 mm	162
Brown Trout	Stalker	2001	100 - 699 mm	2,228
		2004	> 100 mm	365
		2007	100 - 699 mm	408
		2010	100 - 699 mm	334
		2013	100 - 699 mm	563
	Cabin	2001	≥ 100 mm	2,498
		2004	≥ 100 mm	2,156
		2007	100 - 699 mm	308
		2010	100 - 699 mm	303
		2013	100 - 699 mm	1,234
	Martin	2001	100 - 699 mm	900
		2004	100 - 699 mm	904
		2007	100 - 699 mm	640
		2010	100 - 699 mm	566
		2013	100 - 699 mm	895



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# APPENDIX A. Survey Locations

Water	Site #	Gear <sup>a</sup>	Start / Set	End / Pull	Time (h:min)	E	N	Zone	Datum	Note
BELL RAPIDS	1	E-FISH			:15	671358	4745059	11	NAD27	LMB EVAL
BELL RAPIDS	2	E-FISH			:15	670840	4744421	11	NAD27	LMB EVAL
BELL RAPIDS	3	E-FISH			:15	668941	4740057	11	NAD27	LMB EVAL
BELL RAPIDS	4	E-FISH			:15	668495	4738467	11	NAD27	LMB EVAL
BELL RAPIDS	5	E-FISH			:15	669015	4737573	11	NAD27	LMB EVAL
BELL RAPIDS	6	E-FISH			:15	669516	4736854	11	NAD27	LMB EVAL
BELL RAPIDS	7	E-FISH			:15	670846	4743640	11	NAD27	LMB EVAL
BELL RAPIDS	8	E-FISH			:15	669146	472710	11	NAD27	LMB EVAL
BELL RAPIDS	9	E-FISH			:15	668661	4741951	11	NAD27	LMB EVAL
BELL RAPIDS	10	E-FISH			:15	669283	4741080	11	NAD27	LMB EVAL
BELL RAPIDS	11	E-FISH			:15	668939	4740645	11	NAD27	LMB EVAL
BELL RAPIDS	12	E-FISH			:15	668317	4739774	11	NAD27	LMB EVAL
FILER POND	1	CREEL				668661	4738467	11	NAD27	CREEL
HAGERMAN WMA	1	RILEY POND				669015	4741080	11	NAD27	CREEL
HAGERMAN WMA	1	OSTER 1				686968	4741080	11	NAD27	CREEL
HAGERMAN WMA	OSTER LAKE 2	ROTENONE				668661	4741951	11	NAD27	ROTENONE
HAGERMAN WMA	3	ROTENONE				670846	4738467	11	NAD27	ROTENONE

APPENDIX A. Survey Locations (continued)

HAGERMAN WMA	4	ROTENONE				668495	472710	11	NAD27	ROTENONE
HAGERMAN WMA	5	ROTENONE				669015	4743640	11	NAD27	ROTENONE
HAGERMAN WMA	6	ROTENONE				670846	4741080	11	NAD27	ROTENONE
SALMON FALLS CREEK RESERVOIR	1	FWIN GILL NET	1145	940		257543	4673710	11	WGS84	FWIN
SALMON FALLS CREEK RESERVOIR	2	FWIN GILL NET	1200	950		686667	4665046	11	WGS84	FWIN
SALMON FALLS CREEK RESERVOIR	3	FWIN GILL NET	1220	1035		687053	4669830	11	WGS84	FWIN
SALMON FALLS CREEK RESERVOIR	4	FWIN GILL NET	1245	1000		687473	4667393	11	WGS84	FWIN
SALMON FALLS CREEK RESERVOIR	5	FWIN GILL NET	1300	1045		686968	4668752	11	WGS84	FWIN
SALMON FALLS CREEK RESERVOIR	6	FWIN GILL NET	1310	1055		686990	4665753	11	WGS84	FWIN
SALMON FALLS CREEK RESERVOIR	7	FWIN GILL NET	1130	945		686590	4669782	11	WGS84	FWIN
SALMON FALLS CREEK RESERVOIR	8	FWIN GILL NET	1140	1015		685616	4664027	11	WGS84	FWIN
STALKER CREEK	1	E FISH				7300007	4799575	11	WGS84	STR SURVEY
	2	E FISH				7300224	4799882	11	WGS84	STR SURVEY
SILVER CREEK	1	E FISH				7310010	47990098	11	WGS84	STR SURVEY
	2	E FISH				7313050	4799708	11	WGS84	STR SURVEY
SILVER CREEK	1	E FISH				7345340	4800807	11	WGS84	STR SURVEY
	2	E FISH				7344860	4800611	11	WGS84	STR SURVEY

<sup>a</sup> E-Fish: stream electrofishing setup, BEFISH: boat electrofishing setup, SKGNET: sinking gill net, FGNET: floating gill net, THERMO: continuous water temperature loggings, FWIN GILL NET: unique multi-panel gill net used to sample Walleye

## APPENDIX B. Equipment Specifications

Fishery type	Equipment	Description
Lakes & res.	25 gallon Boom Sprayer Scale	Rotenone application with 12 Crestliner Johnboat Pesola <sup>®</sup> : , 0-300 g, 0-1 kg, 0-2.5 kg scales
	Conductivity meter	Yellow Springs Instrument (YSI) model 30
	Depth sounder	Hondex <sup>®</sup> portable depth sounder
	Secci disc	Standard; decimeter graduation
	pH meter	Oakton <sup>®</sup> hand held pH meter - Model 35624.2
	Power electrofisher Boom	Smith-root <sup>®</sup> model SR-18 w/ model 5.0 pulsator Aluminum (2.6 m-long)
	Anode	Octopus-style steel dangles (1 m-long)
	Cathode	Boat and cathode array dangles - simultaneous
	Live well	Fresh flow aerated; 0.65 m <sup>3</sup>
	Oxygen stone	35.6 X 3.8 cm (135 m <sup>2</sup> ); fine pore
	Generator	Honda <sup>®</sup> ; model EG5000x; 5,000 watt
	Electrofishing control box	Midwest lakes ; model VVP
	Sinking gillnet	6 panels (19, 25, 32, 38, 51, 64 mm bar-mesh); 38 x 1.8 m; monofilament
	Floating gillnet	6 panels (19, 25, 32, 38, 51, 64 mm bar-mesh); 38 x 1.8 m; monofilament
	Walleye (FWIN) Gillnet	8 panel (25, 38, 51, 64, 76, 102, 127, 152 mm bar-mesh); 61 x 1.8 m, monofilament
	Trap net	1.8 x 0.9 m box, 5 - 76 cm hoops, 15.2 m lead, 2 cm bar mesh
	Seine	18 m x 1 m, 6 mm mesh 18 m x 1 m, 3 mm mesh
	Conductivity meter	Yellow Springs Instruments <sup>®</sup> (YSI); model 30
	Plankton nets	250, 500, 750 $\mu$ mesh; 0.5 m diameter mouth; 2.5 m depth
	Temperature / D.O. meter	Yellow Springs Instruments <sup>®</sup> (YSI); model 550A
	Dip nets	2.4 m-long handles ; trapezoid heads (0.6 m <sup>2</sup> ); 9.5 mm bar-mesh
	Secci disc	Standard; decimeter graduation

APPENDIX B. Equipment Specifications (continued)

Fishery Type	Equipment	Description
Rivers and streams	Thermograph	Onset-Tidbit© v2 temp logger.
	Field PDA	Juniper Systems ©, model Allegro handheld; waterproof, WinCE/DOS compatible
	Scales	AND© 5000g electronic, OHAUS© 3000g, electronicPesola ©: , 300 g, 1 kg, 2.5 kg, 5.0 kg scales
	Powerboat electrofisher	Smith-root © model SR-18 w/ model 5.0 pulsator - see above for specs.
	Raft	4.9 m-long rubber
	Anode	13.7 m-long power cord; 2.4 m-long fiberglass handle; 0.4 m diameter steel hoop
	Cathode	Boat
	Live well	208 L plastic garbage can; O <sub>2</sub> supplemented
	Drift boat	4.5 m-long aluminum
	Boom	4.3 m-long fiberglass
	Anode	Octopus-style steel danglers (1 m-long)
	Cathode	Boat
	Live well	208 L rubber stock watering tub; O <sub>2</sub> supplemented
	Scales	AND© 5000g,electronic, OHAUS© 3000g,electronic Pesola ©: , 300 g, 1 kg, 2.5 kg, 5.0 kg scales
	Oxygen stone	35.6 X 3.8 cm (135 m <sup>2</sup> ); fine pore
	Generator	Honda © ; model EG5000x; 5,000 watt
	Electrofishing control box	Midwest lakes ©
	Oxygen stone	35.6 X 3.8 cm (135 m <sup>2</sup> ); fine pore
	Dip nets	2.4 m-long handles ; trapezoid heads (0.6 m <sup>2</sup> ); 9.5 mm bar-mesh
	Backpack electrofisher	Smith-root © model 15-D; single anode
	Conductivity meter	Yellow Springs Instrument © (YSI) model 30
	Thermograph	Onset-Tidbit© v2 temp logger.

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